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The American Journal of Obstetrics and Gynecology

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1920—1925

THE current issue commemorates the fifth anniversary of the entrance of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY in the field of periodical medical literature. The editors and publishers take this opportunity of expressing to the profession their appreciation of the cordial support which has been accorded to the venture and trust that their future efforts to continue a journal devoted exclusively to the specialty of obstetrics and gynecology may meet with a similarly favorable response. Since the journal was begun at a period when the depression following the Great War made difficult the establishment of a new enterprise, this hearty response on the part of the medical public is doubly gratifying.

The "American Journal of Obstetrics and Diseases of Women and Children," familiarly known as the "Blue Journal," suspended publication in December, 1919, with the completion of the eightieth consecutive volume. Fully convinced, however, that the medical profession of this country would support a periodical devoted exclusively to obstetrics and gynecology, its former editor immediately undertook to reestablish such a journal under somewhat different auspices. A change in title and editorial policy was instituted,—an advisory board of editors being nominated by the national societies devoted to the advancement of obstetrics and gynecology. The present publishers readily undertook the venture without guarantee or support other than that to be procured from the subscribers to the magazine, which is now the official organ of the various societies listed on its cover page.

The Journal has devoted its pages to a presentation of American research and teaching in all that pertains to the science and art of obstetrics and gynecology. The editors and publishers are proud to record the accomplishment of this purpose, at least to the best of their ability, and trust that the passage of the fifth milestone since its founding will constitute but one of many in the future career of the journal and that it will continue to merit the support and confidence which has thus far been so generously extended by the medical profession.

GEO. W. KOSMAK, M. D.
HUGO EHRENFEST, M.D.
THE C. V. MOSBY COMPANY.

October 1, 1925.

Original Communications

INGUINAL ENDOMETRIOSIS (OFTEN REPORTED AS ENDOMETRIAL TISSUE IN THE GROIN, ADENOMYOMA IN THE GROIN, AND ADENOMYOMA OF THE ROUND LIGAMENT)*

By John A. Sampson, M.D., Albany, New York

(From the Gynecological and Pathological Departments of the Albany Hospital and of the Albany Medical College)

From a diagnostic standpoint, misplaced endometrium-like tissue may be divided into three groups. The histologic structure and associated conditions of that found in the first group are such as to enable one to make a definite diagnosis of endometrial tissue. In the second group, it can be ascertained that the tissue is not endometrial. Its structure is atypical and the gland-like spaces have obviously been derived from inclusions of the peritoneal mesothelium, or their relation to known remnants of the wolffian body may be such as to indicate their origin from these. In the third group the diagnosis is uncertain, due to the small amount of tissue for microscopic study, its atypical structure, and indefinite associations.

Misplaced endometrial tissue may be divided into four, possibly five, groups, according to the manner in which this tissue reached its ectopic situation.

The first group consists of ectopic endometrial tissue in the wall of the uterus, which has arisen from the direct invasion of the myometrium by the mucosa lining the uterine cavity. We might call such a condition a direct or primary endometriosis of the uterus—the so-called uterine adenomyoma of mucosal origin whose etiology has been so ably championed by Cullen. A similar condition occurs in the fallopian tubes from a like invasion of their walls by the mucosa lining their lumina. We also have evidence that suggests the possibility of lymphatic and venous metastases from these invasions.

In the second group implantation-like lesions, similar in their distribution to those of cancer, are found scattered throughout the pelvis. These lesions occur most frequently in the posterior culdesac, on the

*Read (by invitation) at a meeting of the Philadelphia Obstetrical Society, March 5, 1925.

Note: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

posterior surface of the uterus and broad ligaments, in the anterior culdesac and in other natural peritoneal folds and pockets. They are also often found on the lateral and under-surface of the ovaries, on the sigmoid, occasionally on the terminal loop of the ileum, on the appendix and cecum, in fact, on any of the structures present in the pelvis. As in implantation carcinoma, they often invade their host, and it is interesting that the reaction against this invasion is often similar to that of the myometrium against the direct or primary invasion of its tissues by the mucosa lining of the uterine cavity—the so-called uterine adenomyoma. On account of this similarity it is natural that these lesions should have been described as adenomyomas of the sigmoid, rectovaginal septum, uterosacral, ovarian or round ligaments, i.e., of whatever structure is invaded by this tissue. As many of these lesions obviously arise on or from the surface of the peritoneum, it is natural that they should have been described by many investigators as due to a metaplasia of the mesothelium of the serosa.

In many cases of peritoneal endometriosis, ovarian hematomas are also present, which are usually fused by their lateral or under-surfaces with adjacent structures, such as the posterior surface of the broad ligament, uterus, or the side of the pelvis. This fusion is caused by the reaction associated with the invasion of these structures and the ovary by endometrial tissue growing on one or both of them, or from the perforation of the ovarian hematoma, with its subsequent closure by adjacent structures becoming adherent to the ovary. These ovarian hematomas are usually small being from less than a centimeter to two or three centimeters in diameter, but occasionally they reach a large size, filling the pelvis and even extending into the abdominal cavity. A histologic study of these ovarian hematomas has taught us that many (possibly all) of them are of endometrial origin. I believe that the majority of these implantation-like lesions on the peritoneum and ovaries are true implantations derived from bits of endometrial (possibly sometimes tubal) tissue escaping into the peritoneal cavity, either primarily through the fallopian tubes or secondarily from endometrial foci on the surface of the pelvic structures or from ovarian hematomas which have perforated. Blood may occasionally be observed escaping through the fimbriated opening of the fallopian tubes of patients operated upon during menstruation. The distribution of the lesions corresponds to a contamination from such a source. We have evidence that endometrial tissue transplanted by the surgeon may sometimes grow. Jacobson[1] has proved by the experimental autotransplantation of bits of endometrial tissue in rabbits that similar lesions may arise in these animals. A fuller presentation of the data supporting this theory has been given in previous publications.[2, 3] I believe that endometrial tissue in the ovary may have a similar

origin and that endometrial cysts or hematomas arise from it. We may call this group one of peritoneal endometriosis of implantation origin. However, in some instances, the endometrial tissue on or near the surface of the uterus, which might easily simulate an implantation lesion, may have reached this situation by direct extension or metastasis from the uterine mucosa.

Transplantation endometriosis constitutes the third group. Several instances have been reported of endometrial tissue developing in the scar of the abdominal incision after cesarean section and also after other pelvic operations. Lemon and Mahle[4] have recently reported nine instances of the latter occurring in the Mayo Clinic. In their experience such a condition has never been found in the abdominal wall of men. We can readily understand how bits of endometrial tissue could be transplanted into the abdominal wall during a cesarean section, but it is more difficult to explain such an origin from an operation in which the uterine cavity had not been opened. I am fully convinced that the manipulation of the uterus and tubes may easily detach uterine and tubal epithelium and cause it to be transferred not only to the abdominal wound, but also to the field of operation in the pelvis.

The fourth and most interesting group includes extraperitoneally misplaced endometrial tissue in the groin, vulva, and possibly some of those in the vagina, umbilicus and in the pelvis. Should such lesions arise from the mucosa lining the uterine cavity or from its peritoneal implantations, we must conclude that they are truly metastatic and reached their present situation through the lymph vessels or veins. If the latter is true, the name metastatic endometriosis could be given to these lesions.

I do not know whether or not developmentally misplaced müllerian tissue occurs. If so, it would constitute a fifth group.

The only cases of possible metastatic endometriosis through lymphatics or veins that I have had an opportunity to study have been in the uterine wall, in the groin (three in number), and some instances of retroperitoneal pelvic endometrial tissue associated with peritoneal endometriosis. In these latter cases I have been unable to determine whether we were dealing with a true metastasis from a peritoneal lesion or with a direct extension from the latter. The few cases of endometriosis of the vagina which I have seen had extended downward between the vagina and the rectum (the so-called adenomyoma of the rectovaginal septum) and were associated with and apparently directly continuous with a similar lesion involving the peritoneum of the culdesac. I have never seen an instance of endometrial tissue involving the umbilicus and do not feel capable of discussing this lesion.

The first reported instance of endometrial tissue in the groin was published by Cullen,[5] in 1896, as an adenomyoma of the round ligament. The "growth," together with a portion of the round ligament to which it was attached, had been removed by Dr. Howard A. Kelly the previous year. Two years later, a similar lesion was removed from the opposite groin of the same patient. In both of these specimens glands and stroma about them similar to those of the uterine mucosa were found. Cullen believed that the lesion probably arose from developmentally misplaced portions of the müllerian duct. In his work[6] on adenomyoma of the uterus, published in 1908, these two specimens are again reported, together with references to similar lesions found by others in this region. These are all included in the chapter on adenomyoma of the round ligament. Cullen presents the views of those who believe that these growths are derivatives of the wolffian duct and his own reasons for believing that they arise in developmentally misplaced portions of Müller's duct. He concludes that, "It would be unwise to say absolutely that these growths cannot possibly be derived from remains of the wolffian duct, but the evidence is overwhelmingly in favor of the Müller's duct origin."

Misplaced endometrial tissue in the groin has been reported not only as endometrial tissue and as adenomyoma in the groin, but often as adenomyoma of the round ligament. The collected cases of adenomyoma of the round ligament include both those involving the intraperitoneal and those involving or situated near the extraperitoneal portion of that structure. In 1903 Emanuel[7] collected from the literature seventy-six cases of tumors of the round ligament. Fifteen of these were myomas or fibromyomas and some proved to be "adenomyomas"; to the latter he added four cases of his own. In 1914, Taussig[8] reviewed the literature of tumors of the round ligament and stated that adenomyomas were found in 30 of the 135 cases in which the nature of the tumor had been determined.

Lockyer in his work "Fibroids and Allied Tumors,"[9] published in 1918, devotes eleven pages to the subject of adenomyoma of the round ligament. He presents an excellent review of the literature of this condition, including the various theories which had been offered to explain its origin. He states that this condition is about three times as common in the extraperitoneal portion of the round ligament as in the intraperitoneal situation. Up to that time three theories had been presented to explain the origin of these "growths," the müllerian, the wolffian and the serosal. The last is probably best known as the Iwanoff-Meyer theory. The supporters of this theory believe that histologically typical uterine mucosa may arise from a metaplasia of the peritoneal mesothelium and the subsequent reaction of its

underlying tissue. In instances of "extraperitoneal adenomyoma" of the round ligament, the epithelium would be derived from the mesothelium of the processus vaginalis peritonei.

The implantation theory for the explanation of the origin of peritoneal lesions, including those involving the intraperitoneal portion of the round ligament, was published by me, in 1921,[10] and further elaborated the following year.[2]

In two articles,[11, 12] published in 1922, I discussed and demonstrated by photomicrographs the invasion of what I interpreted to be lymph vessels by endometrial tissue which had penetrated the broad ligament from its peritoneal surface in one instance (Fig. 23), and the sigmoid in another, as the result of a peritoneal endometriosis. I stated that these findings suggested that metastasis may occur and thus explain the origin of adenoma of endometrial type found in the groin and other places, just as metastasis to such places may happen in ovarian carcinoma. I also added that metastases might in like manner arise from the direct invasion of the uterine wall by the mucosa lining its cavity and from a similar invasion of the tubal wall by its mucosa.

Ries,[13] Wertheim,[14] Wülfing[15] and others have reported finding epithelial glands or inclusions in pelvic lymph nodes, some of which we now believe may possibly have been metastatic from benign endometrial tissue in the pelvis.

In 1924, Halban[16] published a preliminary communication on the lymphatic origin of misplaced endometrial tissue. He believes that in the invasion of the myometrium by its mucosa, bits of epithelium may be set free in the lymph spaces between the muscle bundles of the myometrium and wander through these to the superficial lymphatics beneath the serosa of the uterine wall, and from there spread by the lymph channels to other pelvic structures, including the inguinal glands. He offers in support of this view the fact that characteristic uterine glands have been found in the regional lymph nodes of the uterus. He and others have criticized the implantation theory because at best it explains only the origin of peritoneal lesions and does not account for some of the extraperitoneal situations of this tissue. I wish to emphasize three facts in connection with these criticisms: 1. The implantation theory was presented only for the explanation of the origin of peritoneal lesions and the conditions resulting from them. 2. The metastatic origin of extraperitoneal lesions was not only considered by me, but reasons given for believing that it might occur. 3. More than one channel is employed in the dissemination of cancer and the same might apply to the dissemination of endometrial tissue.

PERITONEAL ENDOMETRIOSIS WITH INVOLVEMENT OF THE INTRAPERITONEAL PORTION OF ONE OR BOTH ROUND LIGAMENTS (OFTEN REPORTED AS ADENOMYOMA OF THE INTRAPERITONEAL PORTION OF THAT LIGAMENT)

Endometrial tissue in the groin has often been reported as adenomyoma of the round ligament and the endometrial invasion of the intraperitoneal portion of the round ligament has also been reported as a similar growth of that structure and both have been included in the collected cases of round ligament tumors. It would seem pertinent to discuss first the intraperitoneal lesion. It is of much the more frequent occurrence (in my experience). Its origin is easier to under-

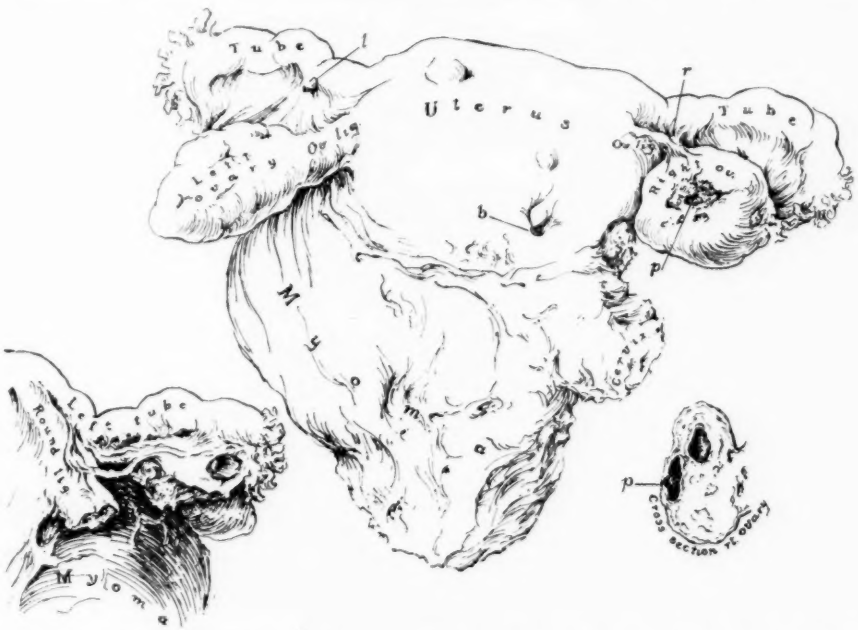

Fig. 1.—Case 1. Peritoneal endometriosis with implants on the posterior surface of the uterus (*b*), the left broad ligament (*l*), about the right ovarian ligament (*r*), the left round ligament and in the culdesac; small endometrial hematoma of the right ovary. Posterior view of the uterus, tubes and ovaries removed at operation, with inserts of the left round ligament and of a cross section of the right ovary (X⅝). The scars and adhesions resulting from the peritoneal endometriosis are indicated and also the characteristic appearance of the right ovary the seat of a small endometrial hematoma. The latter had either perforated (*p*) causing the ovary to become adherent by its under surface to the posterior surface of the uterus, or else endometrial tissue had simultaneously invaded these two structures. The endometriosis of the left round ligament is but one of similar lesions of implantation origin involving several pelvic structures, (see Fig. 2), as in peritoneal carcinosis. The endometrial tissue was probably primarily derived from menstrual blood escaping through the tubes into the peritoneal cavity. There was no evidence found of an invasion of the uterine wall by its mucosa.

stand and both conditions may be present in the same individual (Case 6) and possibly in some instances the lesion in the groin may have originated from the other. I have encountered eight cases of peritoneal endometriosis with involvement of the intraperitoneal portion of one or both round ligaments.

CASE 1 (Case 22 of a previous series[10]).—The patient, aged forty-one, complained of pain in the lower left abdomen, dysmenorrhea, and constipation. She had two children, thirteen and ten years of age. Menstruation was regular, moderate in amount, and painless until three years before the operation. The menstrual pain had increased in severity and was so intense that the patient was confined to her bed for one day. The operation at the Albany Hospital, April 7, 1921, revealed a multinodular myomatous uterus with the largest myoma, about 9 cm. in its greatest diameter, extending between the layers of the left broad ligament. The right ovary was adherent to the posterior surface of the uterus and in freeing it a small amount of chocolate-colored fluid escaped. Both tubes were apparently patent. The uterus, both tubes and ovaries, and the appendix

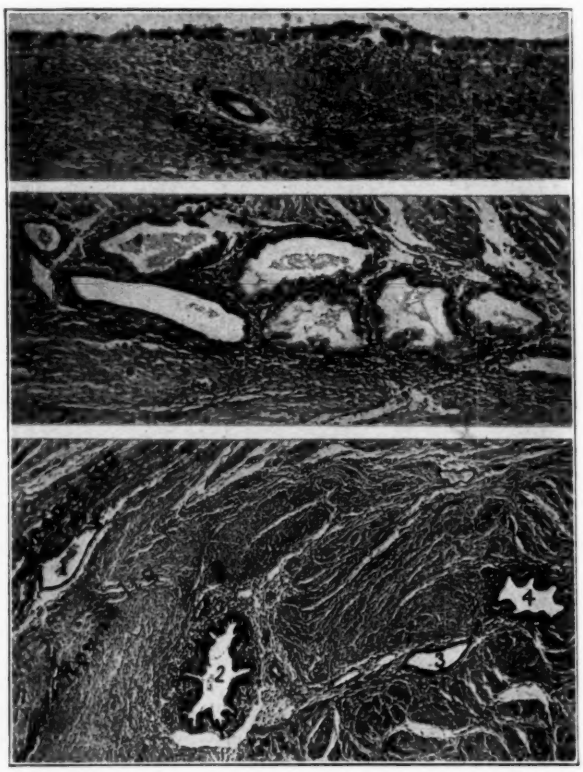

Fig. 2.—Case 1. Three photomicrographs (X60) showing the histologic structure of a portion of the wall of the endometrial hematoma of the right ovary, the endometrial implant involving the right ovarian and broad ligaments, and the endometriosis of the left round ligament (Fig. 1).

were removed. The patient made a satisfactory convalescence. A condition of peritoneal endometriosis was present with endometrial deposits in the culdesac and also invading the posterior uterine wall, the left broad ligament, the right ovarian ligament and the left round ligament (Fig. 1). A small endometrial hematoma was present in the right ovary which had either perforated or in its development had become fused with the posterior surface of the uterus. The left round ligament near its uterine attachment had been invaded by endometrial tissue apparently deposited on its peritoneal surface. The round ligament was but one of several pelvic structures invaded by endometrial tissue (Figs. 1 and 2), and in no way contributed to the discomfort of the patient.

CASE 2 (Case 8 of a previous series[12]).—The patient, aged forty-seven, complained of pain in the lower left abdomen and of marked constipation at the menstrual periods. She had had one child, ten years before. Menstruation was moderate in amount and had always been associated with some pain. The pain had gradually increased in severity during the last three years and especially during the last four months, so that she had to spend one or two days in bed. The patient did not have any pain between the menstrual periods. The operation at the Albany Hospital, July 21, 1921, revealed that the uterus was retroflexed with the sigmoid adherent to the fundus. A hematoma of the left ovary, about 4 cm. in its greatest diameter, was present, and was densely adherent to the side of the pelvis. In freeing the hematoma a large amount of chocolate-like fluid escaped. The uterus was firmly adherent to the sigmoid and rectum. The uterus, both tubes and ovaries, and the appendix were removed. The patient made a satisfactory convalescence. A condition of peritoneal endometriosis was

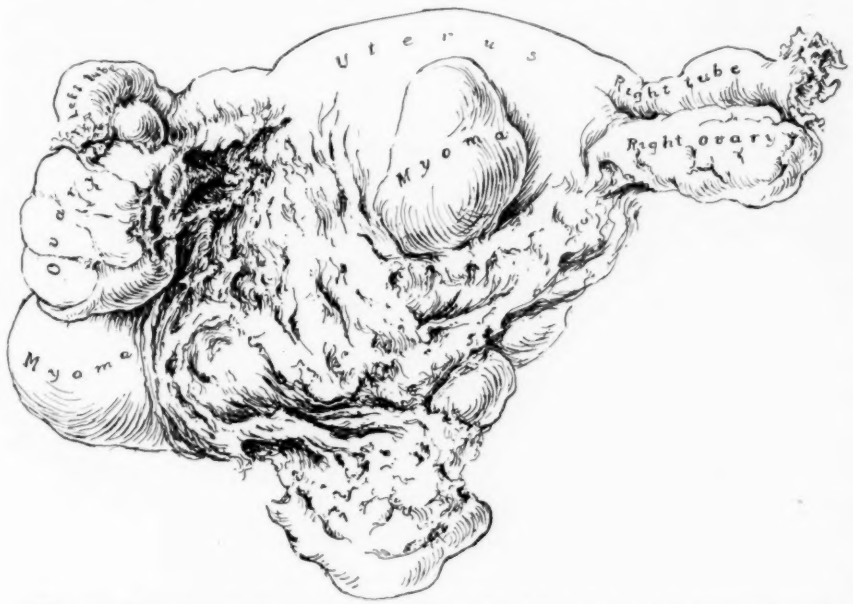

Fig. 3.—Case 3. Peritoneal endometriosis involving the greater portion of the posterior wall of the uterus (and probably also the sigmoid, to which the uterus was firmly adherent), the left ovary, tube and broad ligament, the left round ligament, the terminal loop of the ileum (Fig. 10) and the appendix (Figs. 11 and 13). Posterior view of the myomatous uterus and the tubes and ovaries ($X\frac{5}{7}$). The greater portion of the roughened posterior uterine wall is superficially invaded by endometrial tissue. The left ovary (turned upwards) is invaded by endometrial tissue (Fig. 9) as is also the left broad ligament (Fig. 7). A possible direct or primary uterine endometriosis was found only in one small area of the uterine wall and that in the left uterine cornu (Fig. 4). The lumen of the left tube contained blood (patient had been bleeding for five weeks prior to the operation). The endometrial tissue of the many implantation-like lesions in this case might have been derived (*a*) from menstrual blood escaping through the tubes (the most likely source) or (*b*) from endometrial tissue reaching the surface of the uterus, metastatic from primary uterine endometriosis which subsequently reacted to menstruation; or from both of these sources.

present, with an endometrial invasion of the posterior uterine wall, the anterior wall of the rectosigmoid, and the anterior wall of the uterus about the origin of the left round ligament. An endometrial hematoma was present in the left ovary which had apparently perforated. As in the previous case the endometrial invasion of the round ligament was but one of the similar lesions of implantation origin involving other pelvic structures and was of no clinical significance.

CASE 3.—The patient, aged thirty-seven, complained of uterine bleeding of five weeks' duration. She had been married for ten years and had never been pregnant. Menstruation was regular and had always been painful. (Her sister was operated upon by me, in 1920, for an endometrial hematoma of the right ovary, associated with an endometrial invasion of the posterior wall of the cervix, the vagina, and the anterior wall of the rectum—Case 13 of a previous series.[10]) The preoperative diagnosis was a right inguinal hernia and adherent myomatous uterus. The operation, at the Albany Hospital, June 19, 1923, revealed a multinodular myomatous uterus with the largest myoma extending between the layers of the left broad ligament. The posterior wall of the uterus was densely adherent

Fig. 4.—Case 3. Photomicrograph (X10) of a horizontal section through the posterior wall of the left uterine cornu. Multiple small endometriomyomas are present in the uterine wall, apparently just beneath its serosa and probably of implantation origin, although the endometrial tissue may have reached this situation by metastasis through veins or lymphatics from the uterine mucosa. Endometrial tissue is shown in the right lower corner, which may have arisen directly from the uterine mucosa (suggested but not proved) or from the invasion of the peritoneal implantations. Endometrial tissue is present, apparently lying free, in the lumen of a vessel (*V*). I was unable to determine whether this vessel was a vein or lymphatic, or how the endometrial tissue reached its lumen whether by invasion or metastasis from the peritoneal implantations or from a possible primary uterine endometriosis.

to the rectosigmoid. A distinct endometrial invasion of the terminal loop of the ileum was found, with partial obstruction of the same, as indicated by the distention of the intestine above it (Fig. 10). The lesion in the ileum was not disturbed. The appendix, both tubes and ovaries, and the uterus were removed and the hernia was repaired. The patient made a satisfactory convalescence. A condition of peritoneal endometriosis was present (Fig. 3) with an endometrial

invasion of the left ovary (Fig. 9) and tube, left broad ligament (Fig. 7), posterior uterine wall (Figs. 4 and 6), appendix (Figs. 11 and 13), the left ligament (Figs. 12 and 14), the sigmoid and the ileum. The uterus contained multiple leiomyomas, a large endometrial polyp, and possibly a primary endometriosis from

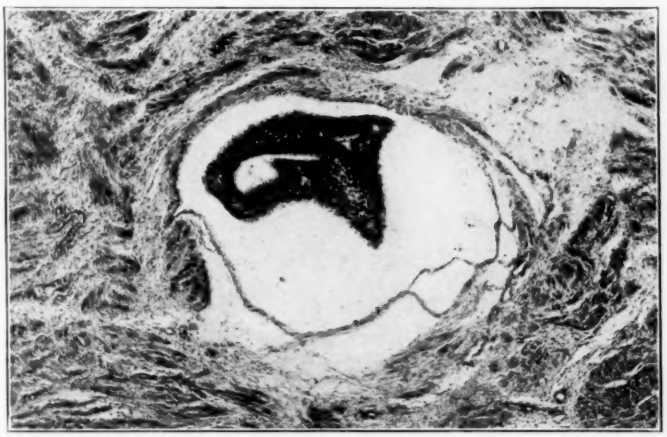

Fig. 5.—Case 3. Photomicrograph (X60) of the vessel (vein or lymphatic) containing endometrial tissue shown in Fig. 4. Should this tissue react to menstruation, as ectopic endometrial tissue wherever situated may, (Fig. 25) fragments of it might metastasize to other portions of the uterine wall or even be carried to structures outside of the uterus.

Fig. 6.—Case 3. Photomicrograph (X10) showing endometriosis of the right side of the posterior uterine wall either from endometrial tissue implanted on its surface (upper half) and subsequently invading the uterus or from a direct extension or metastasis from the suggested primary endometriosis shown in Fig. 4. A circumscribed leiomyoma (to the left) has developed about a dilated gland.

the invasion of its wall by the mucosa of the left cornu with evidence suggesting venous or lymphatic metastasis from this (Figs. 4 and 5). The right tube and ovary were apparently normal. Both tubes were patent, but the left one was partially stenosed at its fimbriated extremity and contained blood in its lumen (the patient was flowing at the time of the operation). The hernial sac did not contain any

Fig. 7.—Case 3. Photomicrograph (X10) showing the endometrial invasion (endometriosis) of the left broad ligament either from endometrial tissue implanted on its posterior surface (to the left) or possibly metastatic from a primary endometriosis suggested in Fig. 4. Endometrial cavities, similar to that in the ovary (Fig. 9) but smaller have developed in the tissues of the broad ligament.

endometrial tissue. An ovarian hematoma was not present, although the left ovary had been invaded by endometrial tissue similar to that in the other pelvic structures. The endometrial invasion of the round ligament was but one of similar lesions, many of implantation origin, involving other pelvic structures and was of no clinical significance.

Fig. 8.—Case 3. Photomicrograph (X10) of a cross section of the left tube showing endometrial tissue in its posterior wall. It suggests an implantation lesion similar to those in the appendix (Fig. 13).

CASE 4.—The patient, aged fifty-one, complained of excessive menstruation, pain in the lower right abdomen, and indigestion. She had had one child, twenty-eight years before. The appendix had been removed at the age of seventeen. Menstruation was irregular and had been excessive in amount for over a year. The preoperative diagnosis was a myomatous uterus and possible adhesions at the site of her previous operation. The operation, at the Albany Hospital, December 29, 1923, revealed a multinodular myomatous uterus, adhesions about the terminal loop of the ileum, and gallstones. The terminal loop of the ileum was freed, both tubes and ovaries, the uterus, and the gallstones were removed. The patient made a satisfactory convalescence. A condition of peritoneal endometriosis was present with deposits of endometrial tissue in the posterior culdesac and also in the anterior culdesac, in the vesicouterine fold of the peritoneum

Fig. 9.—Case 3. Photomicrograph (X10) showing endometrial tissue (*end.*) on the under surface of the left ovary and an endometrial cavity in that organ which arose from the invasion of it by this tissue. The accumulation of menstrual blood in this cavity would have given rise to an endometrial hematoma. Such hematomata are usually small, but may reach a large size. The lesion in the ovary suggests either an implantation or a direct extension from endometrial tissue on the surface of the uterus to which the ovary was adherent.

and about the uterine origin of both round ligaments. Both tubes and ovaries were apparently normal and endometrial tissue was not found in either ovary. The endometrial invasion of the round ligaments was but one of similar lesions of implantation origin involving other pelvic structures and none of them were of any clinical significance.

CASE 5.—The patient, aged fifty, complained of profuse menstruation and marked constipation. She had been married for twenty-six years and had never been pregnant. Menstruation had always been regular and painful. For a little over a year it had been increasing in amount and was of longer duration. In 1900, the right tube and ovary were removed for some sort of an ovarian cyst,

by the late Dr. W. W. Seymour, of Troy, N. Y. I have been unable to determine the exact nature of the cyst. In 1906, tissue was excised from the vaginal vault just posterior to the cervix, by the late Dr. E. D. Ferguson, also of Troy, N. Y. A tentative diagnosis of adenocarcinoma was made of this tissue. Dr. H. W. Carey, pathologist of the Samaritan Hospital, Troy, N. Y., very kindly sent the slides from this tissue to me. The tissues of the vagina were invaded by glands of the structure of uterine glands, with stroma about them histologically identical with that of the endometrium. With our present knowledge of the subject we would not hesitate to make a diagnosis of endometrial tissue.

Fig. 13.—Case 3. Two photomicrographs (X8) of cross sections of the appendix shown in Fig. 11. The one to the left is through the base of the appendix which was crushed in removal. The greater portion of the muscular wall is absent. Characteristic endometriosis of the muscularis of the appendix is shown in the lower half of the photomicrograph. The other photomicrograph is of a section through the appendix near its tip. It has been invaded by endometrial tissue apparently implanted on its peritoneal surface at the attachment of the mesoappendix. Normal-sized (*e*) and dilated glands (*d*) have arisen from this invasion as well as a mass of uterine mucosa (*m*). Ciliated epithelium was present in some of the glands. The lumen (*l*) is obliterated in this portion of the appendix.

On pelvic examination the uterus was found to be slightly enlarged, retroflexed, and densely adherent, with a nodular induration in the posterior culdesac between the uterus and the rectum. The preoperative diagnosis was a peritoneal

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Fig. 10 (Plate 1).—Case 3. Endometriosis of the terminal loop of the ileum (natural size from sketch made at the operation). The puckering and scarring of the intestine presented the same general appearance as the endometriosis of the appendix (Fig. 11), the anterior surface of the uterus about the left round ligament (Fig. 12) and other organs and structures involved in the peritoneal endometriosis. The wall of the intestine beneath the scars was indurated causing a narrowing of its lumen. I believe that had this area been excised it would have shown an endometrial lesion similar to that in Fig. 14.

Fig. 11 (Plate 1).—Case 3. Endometriosis of the appendix (natural size) showing the appearance of the characteristic lesions arising from the invasion of the appendix by endometrial tissue "implanted" upon it in three places (see Fig. 13).

Fig. 12 (Plate 1).—Case 3. Endometriosis involving the anterior wall of the uterus and the left round and broad ligaments (natural size). The appearance of the characteristic lesion resulting from the reaction against the invasion of endometrial tissue in this situation is well shown. The gross appearance of the lesion, with the broad ligament adherent to it, is that of an implantation and the microscopic study of it (Fig. 14) suggests the same.

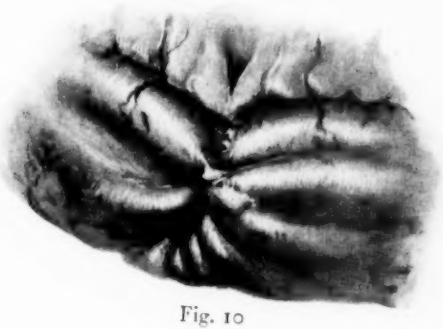

Fig. 10

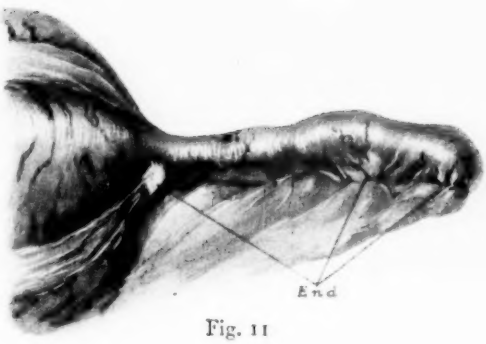

Fig. 11

Fig. 12

PLATE I

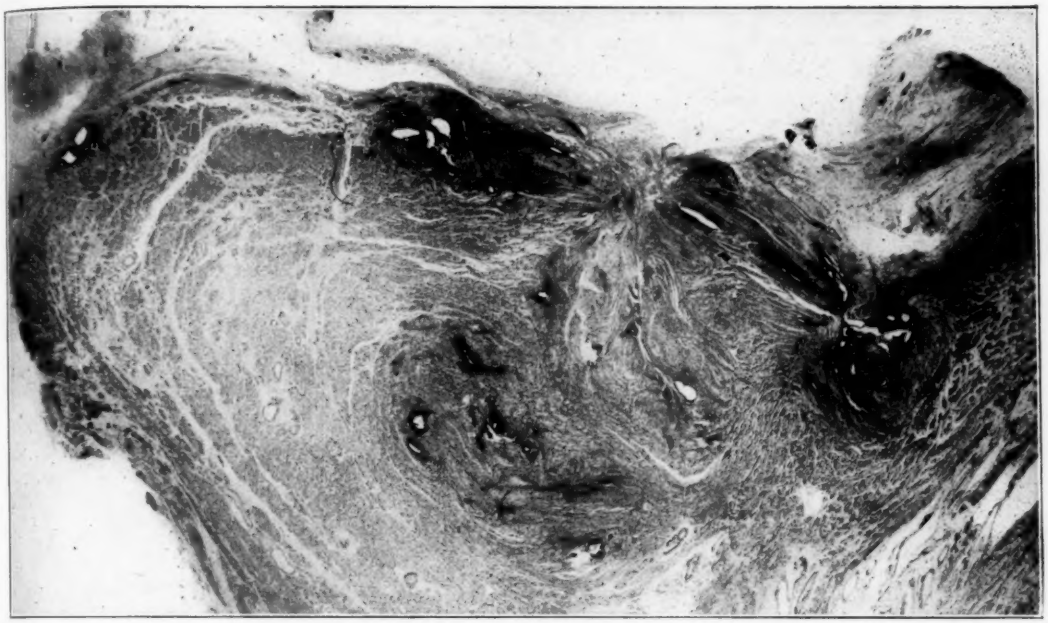

Fig. 14.—Case 3. Photomicrograph (X7) of the round ligament and portion of the anterior wall of the uterus below it, showing the characteristic invasion of these structures from endometrial tissue "implanted upon" them and the reaction against the same; (see also Figs. 10 and 13). The round ligament is situated in the left half of the photomicrograph and the uterine wall with fold of the broad ligament adherent to it in the right half. While the origin of the endometrial tissue in this situation from a metastasis through vessels from a possible primary endometriosis cannot be excluded, the whole picture suggests an implantation lesion similar to those involving the ileum and the appendix.

Fig. 15.—Case 3. Anterior view of the uterus, tubes, and ovaries (X½) showing the endometriosis of the left round ligament (see Figs. 12 and 14). It was the only endometrial lesion on the anterior surface of the uterus (compare with Fig. 3). The endometriosis (so-called adenomyoma) of the round ligament was but one of similar lesions, many of implantation origin, involving other pelvic organs and structures as indicated in the preceding illustrations.

endometriosis, with involvement of the rectum and posterior wall of the uterus—a so-called adenomyoma of the rectovaginal septum. The operation at the Albany Hospital, November 25, 1924, revealed a slightly enlarged, retroflexed uterus, firmly adherent to the anterior wall of the rectum (Fig. 16). The right tube and ovary had been removed. The slightly enlarged left ovary was fused by its lateral surface to the posterior layer of the left broad ligament. The left tube was apparently patent, but adherent to the left round ligament, so that its fimbriated extremity pointed upwards (see Fig. 19). There was definite scarring of the sigmoid, at the level of the pelvic brim, with marked induration of the wall of the intestine beneath the scars (Figs. 16 and 18), undoubtedly due

Fig. 16.—Case 5. Peritoneal endometriosis fusing the posterior wall of the lower portion of the uterus with the rectosigmoid; endometrial lesions involving the uterus, rectosigmoid, sigmoid, left ovary, and left round ligament. Condition found at operation after freeing the uterus from the rectosigmoid and exposing the pelvic cavity. (X½). The right tube and ovary had been removed in 1900. The extensive endometriosis in the culdesac had not only fused the uterus with the rectosigmoid, but had extended downward between the rectum and vagina; a portion of it had been removed from the vaginal vault, in 1906. The left ovary contained an endometrial hematoma fusing the ovary with the posterior uterine wall and with the posterior layer of the left broad ligament. Three scars from endometrial implantation (*end.*) are shown on the anterior surface of the sigmoid at the level of the pelvic brim (see also Fig. 18). The wall of the sigmoid beneath the upper two scars is thickened and indurated by the reaction against the endometrial invasion of that organ as indicated by the dotted lines. The smallest and most superficial of these three lesions was excised (see Fig. 20).

to an endometrial invasion of the sigmoid. A very much smaller and more superficial lesion of the sigmoid was excised (see Fig. 20). There was also an extensive endometrial invasion of the tissues of the left broad ligament and sides of the pelvis, at the level of the cervix. The appendix, left tube and ovary, and the entire uterus were removed. The patient made a satisfactory recovery. The enlargement of the uterus was due to the endometrial invasion of the uterine wall, apparently from its posterior surface and also from its lateral surface where the tube and ovary had been removed (Fig. 17). In addition, a small submucous leiomyoma and endometrial polyp were present. The ovary contained a hematoma about 2 cm. in its greatest diameter which had become fused with the posterior surface of the left broad ligament. Its contents resembled chocolate syrup and its walls contained pigment. An epithelial lining was not found, but I believe that it was formerly lined by endometrial tissue. There was present between the layers of the left broad ligament a tumor the greatest diameter of which

Fig. 17.—Case 5. Endometrial lesions involving the uterus (X⅔). The upper insert shows the appearance of the posterior surface of the uterus, left tube and ovary removed at operation. The uterus is irregularly enlarged, due to endometriomyomas developing in its walls and a submucous leiomyoma. The sagittal section of the uterus shows a submucous leiomyoma and an endometrial polyp. An endometriomyoma has developed in its posterior wall following the invasion of endometrial tissue probably "implanted" on its posterior surface (its metastatic origin, through vessels, from the uterine mucosa cannot be excluded). The cross section of the uterus shows the submucous myoma, polyp, and endometriomyoma of the posterior uterine wall and also endometriomyoma in the right side of the uterus, possibly arising in the wound caused by the removal of the right tube and ovary. The smallest insert shows a cross section of the left tube and round ligament taken through the plane *a* of the upper insert. An endometriomyoma has developed in the round ligament (Fig. 21) similar to those in the uterus and sigmoid.

was about 2.5 cm. This tumor, which felt like a leiomyoma, apparently arose from the left round ligament near its uterine attachment (see Figs. 17, 19 and 21), and proved to be an endometrio-leiomyoma, i. e., it arose from an endometrial invasion of the round ligament, with a subsequent reaction against this invasion, resulting in a definite circumscribed leiomyoma enveloping the endometrial tissue. It is evident that the endometrial lesion of the round ligament was but one of similar lesions involving other pelvic structures, including the sigmoid.

CASE 6.—The sixth instance of endometriosis of the intraperitoneal portion of the round ligament was associated with endometriosis in the groin and is reported plained of pain in the lower left abdomen and of marked constipation at the in that series.

The material from the other two cases has not been completely studied as the patients were operated upon the week preceding the presentation of this paper. For that reason they are referred to, but not fully reported, in this communication.

In this series of eight instances of endometrial invasion of the intraperitoneal portion of the round ligament, similar lesions were present, involving other pelvic structures, and in none of these cases was the round ligament lesion of any clinical significance. A condition of peritoneal endometriosis was present in all cases similar in its distribution to that found in the implantation of cancer in peritoneal carcinosis secondary to carcinoma of the pelvic organs. In four of these eight cases an endometrial hematoma of one of the ovaries was also

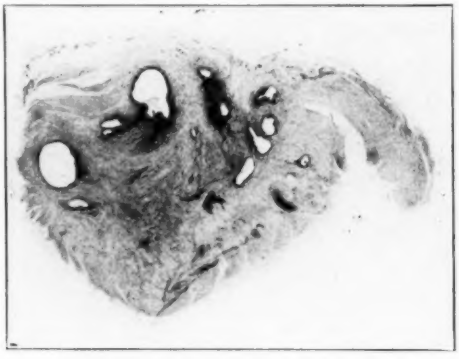

Fig. 20.—Case 5. Photomicrograph (X10) of the smallest and most superficial implantation lesion of the sigmoid shown in Figs. 16 and 18. Its histologic structure is identical with that of the endometrial lesions of the uterine wall shown in Fig. 17 and of the round ligament (Fig. 21), and all might have had a similar origin.

present (both ovaries in one patient). In three others a small amount of endometrial tissue was present in one or both ovaries without the development of an endometrial cyst or hematoma. In the remaining case, endometrial tissue was not present in either ovary. I believe that in all eight cases the peritoneal endometriosis was mainly of

Fig. 18 (Plate 2).—Case 5. The appearance of the endometrial scars on the sigmoid shown in Fig. 16 (natural size). For the extent of the endometriosis beneath the larger scars see Fig. 16.

Fig. 19 (Plate 2).—Case 5. The appearance of the upper surface of the left round ligament and tube (natural size). The tube is adherent to the round ligament with its patent fimbriated extremity projecting above the latter. Recent implantations, indicated by the pigmented blebs, are shown on the peritoneal surface of the ligament. For the histologic structure of these and that of the round ligament beneath the larger group of implantations see Fig. 21.

Fig. 48.—Case 7. (Plate 2.) Gross appearance of the nodule of endometriosis in the right groin (natural size) arising in tissue lateral to the terminal portion of the round ligament. Fat, hyperplastic, connective tissue and the dilated cavities filled with blood are shown.

Fig. 49.—Case 7. (Plate 2). Gross appearance of a section of this nodule (after fixation in formalin). The hematomas arising from the retention of menstrual blood in cavities are well shown.

Fig. 18

Fig. 19

Fig. 48

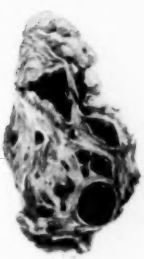

Fig. 49

PLATE II

implantation origin, being derived primarily from epithelium escaping through the tubes, during menstruation and secondarily in some instances from the menstrual reaction of endometrial foci on the surface of the peritoneum or the perforation of an ovarian hematoma. In Case 3 metastases, through veins or lymphatics, from a possible primary uterine endometriosis may have given rise to some of the superficial endometrial lesions of the uterine wall.

Fig. 21.—Case 5. Photomicrograph (X5) of a cross section of the left tube and round ligament indicated by *a* of Fig. 17 and through the larger group of recent peritoneal implants shown in Fig. 19. The tube (upper left corner) is cut in three places and is adherent to the round ligament. The latter, in this situation is invaded by, and in other sections is shown to be replaced by, an endometriomyoma similar in its histologic structure to those in the uterine wall and sigmoid. Recent endometrial implants are indicated on the peritoneal surface of the endometriomyoma. The endometriosis of the round ligament was but one of similar lesions, many of implantation origin, involving other pelvic organs and structures.

THE ORIGIN OF THE ENDOMETRIAL TISSUE IN INGUINAL ENDOMETRIOSIS, (OFTEN REPORTED AS ADENOMYOMA OF THE GROIN AND OF THE EXTRAPERITONEAL PORTION OF THE ROUND LIGAMENT)

Four theories may be considered for the explanation of the origin of this tissue in this situation:

1. The congenital theory. The condition arises in developmentally misplaced portions of the müllerian or wolffian system.

2. The serosal theory. It is due to a metaplasia of the mesothelium lining the processus vaginalis peritonei or of the endothelial lining of dilated vessels.

3. The implantation theory. This would be applicable only for endometrial tissue in a hernial sac.

4. The metastatic theory. Metastasis through the lymph vessels or veins, from either a peritoneal implant invading a near-by vessel or from vessels reached in the invasion of the uterine wall by the mucosa lining the uterine cavity as a part of a direct endometriosis or from endometrial tissue escaping into uterine vessels during menstruation, or from the invasion of the tube by its mucosa.

The congenital theories have been thoroughly discussed by others. My reaction towards the serosal theory as an explanation of true peritoneal endometriosis is the same as my reaction towards such a theory as an explanation for secondary peritoneal carcinosis.

I believe that endometrial implantations may occur in hernial sacs. I have operated upon only two patients with hernias who also had a peritoneal endometriosis. One is reported in this article and there was not any evidence of peritoneal endometriosis of the hernial sac. In the other—with extensive peritoneal endometriosis—the hernial sac

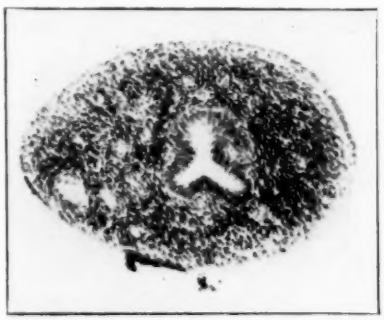

Fig. 22.—Case 5. Photomicrograph (X130) of a cross section of a miniature endometrial polyp on the peritoneal surface of the left round ligament shown in Fig. 21. A typical endometrial gland is present, surrounded by endometrial stroma. Compare with Fig. 39, showing a similar condition.

(femoral) was filled with old blood. There was a reaction against this blood by the tissues of the sac with a metaplasia of portions of its mesothelial lining and in other places a loss of this. A few gland-like structures were present which might have been of endometrial origin, but more closely resembled inclusions of the peritoneal mesothelium. There was a large amount of blood pigment in phagocytic cells in the wall of the sac.

THE LYMPH VESSELS AS CHANNELS FOR THE METASTASIS OF ENDOMETRIAL TISSUE TO THE GROIN

Misplaced endometrial tissue at times may be found invading lymph vessels from a peritoneal endometriosis as has already been demonstrated by me[12] (Figs. 23 and 24). Should this tissue react to menstruation (Fig. 25) and portions of it be set free in the lumen of the lymph vessel, it could easily be carried to other parts of the body and might grow wherever it lodged. The same would be true in the inva-

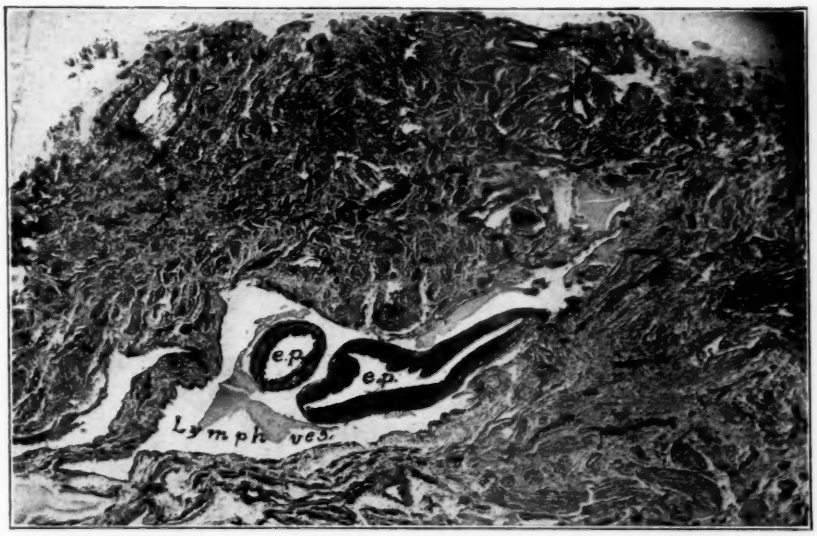

Fig. 23.—(Case 2 of a previous series.) Photomicrograph (X25) of a portion of the left broad ligament containing a lymph vessel (I believe that it is not a peritoneal inclusion cavity) with endometrial tissue in the form of polyps (*e. p.*) protruding into its lumen. Should this tissue react to menstruation, as ectopic endometrial tissue often does (Fig. 25), fragments of it might escape into the lumen of the vessel and metastases might occur in situations reached by this vessel. Endometrial tissue (*a*) is present on the surface of the broad ligament and also in its deeper tissues. The origin of the smaller "polyp" is shown in Fig. 24. An extensive peritoneal endometriosis was present involving the posterior surface of the uterus, both ovaries, broad ligaments, culdesac, and sigmoid.

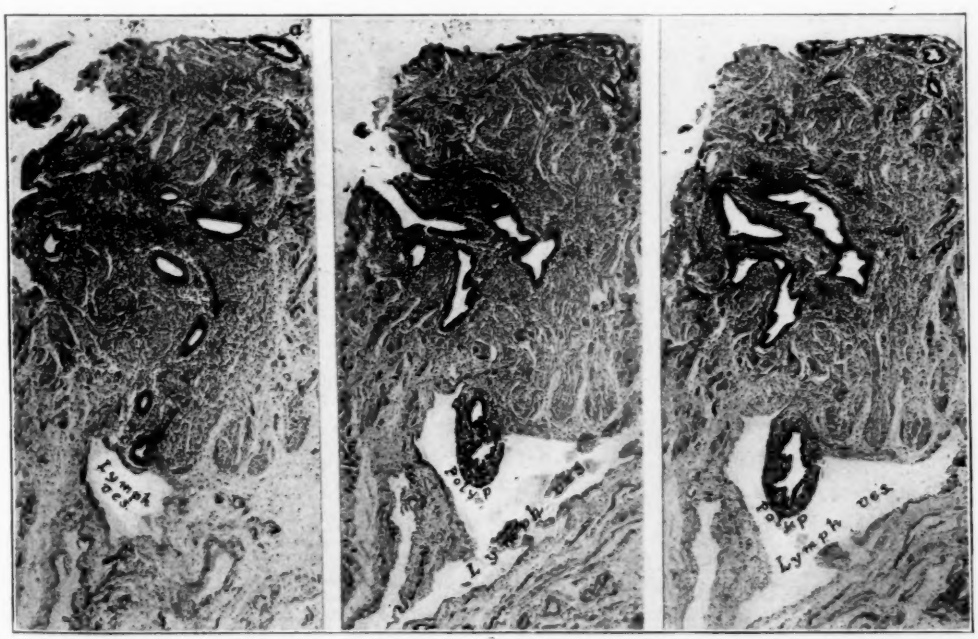

Fig. 24.—Three photomicrographs (X25) demonstrating the origin of the smaller endometrial polyp, shown in Fig. 23, from endometrial tissue implanted on the surface of the broad ligament with subsequent invasion of the tissues of that structure including the lymph vessel.

sion of lymph channels reached by the direct invasion of the uterine and tubal walls by their mucosa. Should metastasis occur we should expect to find endometrial tissue in the pelvic lymph nodes. Gland-like structures similar to those of the uterine mucosa have been found in the retroperitoneal lymph nodes by Ries, Wertheim, Wülfing and others. I have never found them, although I have been looking for them ever since I recognized the endometrial invasion of lymph vessels, in 1921. Nor have I observed them in extensive studies which I have made of the regional lymphatics removed in cancer of the uterine cervix. In these studies I looked for these gland-like inclusions because Dr. F. J. Taussig, of St. Louis, called my attention to them, in 1902. I have carefully palpated the sides of the pelvis, in many of

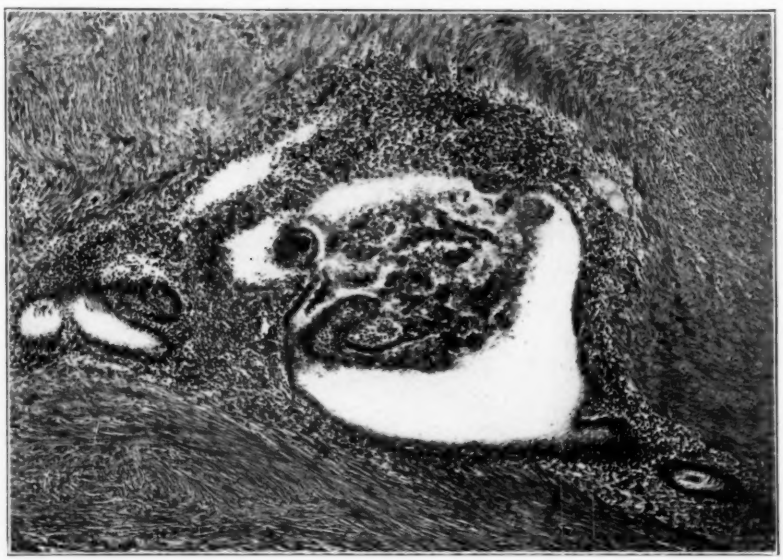

Fig. 25.—Photomicrograph (X60) of a miniature endometrial cavity in the posterior uterine wall associated with and arising from an extensive peritoneal endometriosis involving the posterior wall of the uterus, left broad ligament, left ovary, and sigmoid. The patient was menstruating at the time of the operation. Blood, epithelium, and fragments of endometrial stroma are present in the lumen of the dilated gland forming the lumen of this cavity. Should such a reaction occur in endometrial tissue protruding into the lumen of a lymph vessel or vein (Figs. 5 and 23), some of these fragments might escape into these vessels and be carried to other parts of the body.

my patients with peritoneal endometriosis, operated upon during the last four years, for any evidence of metastatic retroperitoneal endometriosis and have detected only one hard retroperitoneal lymph node. This was situated between the layers of the broad ligament along the uterine vessels where they cross the ureter. It was removed. Serial sections of the node with the indurated tissue about it were made. I was rewarded by finding typical uterine glands in the tissue about the capsule of the node, but none in the node itself (Fig. 26). I was unable to detect any evidence of a direct extension from intraperitoneal endometrial tissue in this situation. I have often encountered

endometrial tissue between the layers of the broad ligament and retroperitoneally along the sides of the pelvis, but have thought that it arose from the direct extension of the endometrial tissue involving the peritoneum in these situations rather than from metastasis. We should expect to find such metastases not only in the pelvic nodes, but especially in the lumbar nodes, because these are the nodes reached by lymph channels extending from the body of the uterus and most accessible to misplaced endometrial tissue arising from the direct invasion of the uterine wall, as well as from that invading the upper portion of the broad ligament through implantation. For the same reasons we should expect that metastases might occur in the groin through the lymphatics accompanying the round ligament. Occasionally, metastases are found in this situation in patients with peritoneal carcinosis associated with malignant ovarian tumors (see Fig. 27).

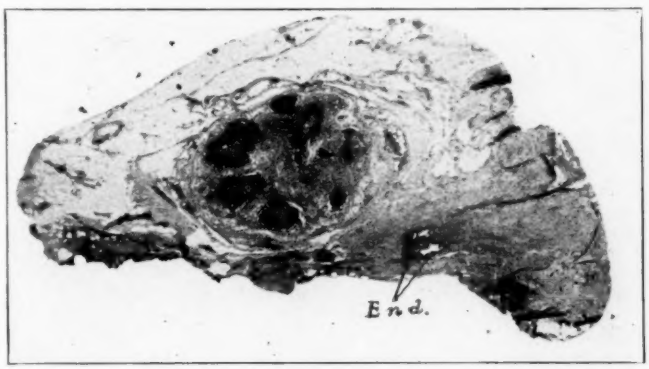

Fig. 26.—Photomicrograph (X10) of a small lymph node with its surrounding tissue, situated near the crossing of the left ureter by the uterine vessels. The patient had an extensive peritoneal endometriosis, but no endometrial implantations on the peritoneum near this node. Endometrial tissue (*end.*) is present outside of the capsule of the node. I believe that it might have been metastatic from the peritoneal endometriosis, possibly that involving the posterior wall of the cervix.

It must also be borne in mind that metastasis in the groin is readily detected in the patient, while a retroperitoneal metastasis, especially in the lumbar region, would be easily overlooked even at operation.

THE VEINS AS AVENUES FOR THE DISSEMINATION OF ENDOMETRIAL TISSUE

Bacteria easily gain access to the veins of the puerperal uterus. If gelatine containing bismuth or barium is forced into the cavity of the uterus removed at operation, it readily escapes into the uterine veins, if the endometrium has been removed or if it is not intact. Syncytial cells have been found in the lungs of women dying during labor. In chorioepithelioma metastases take place by the venous channels and are most frequently found in the lungs and in the vagina. We appreciate that in pregnancy conditions are especially favorable for the dissemination of bacteria and cells through the veins, possibly much more so than in the nonpregnant condition. A histologic study[17] of

the menstruating uterus in which the veins have been injected suggests that occasionally endometrial tissue might escape into the receiving venous sinuses of the uterine mucosa and remain in the uterine wall or even be carried to the lungs or become lodged in some of the branches of the vaginal plexus of veins and grow there, just as metastatic chorioepithelioma arises in these situations. Some of the misplaced endometrial tissue found in the uterus, vagina, and vulva or even in the groin might have such an origin.

A study of the entire subject of endometrial invasion suggests that metastasis possibly occasionally occurs through the lymph channels and even through the veins. The broad ligament is often invaded in peritoneal endometriosis, and the lymph vessels in its upper

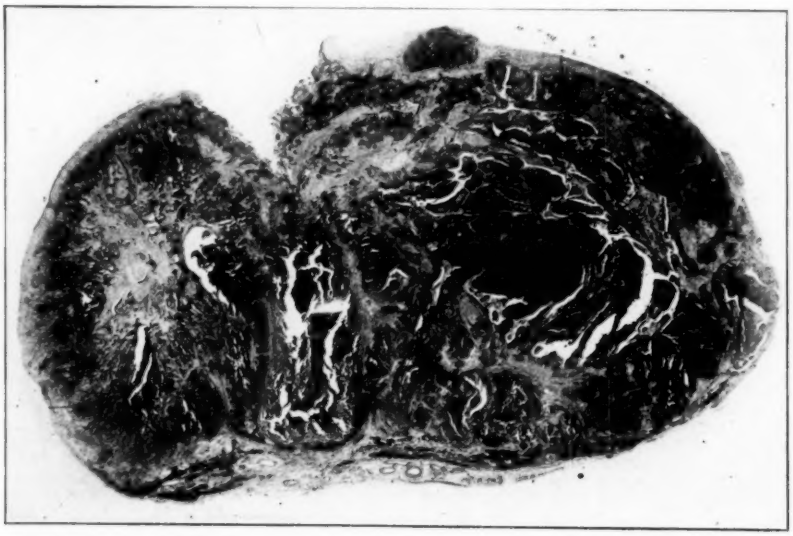

Fig. 27.—Photomicrograph (X5) of a metastasis of cancer in the groin. The patient had a peritoneal carcinosis of ovarian origin. Endometrial tissue is sometimes found in the groin. In two of my three cases it was associated with a peritoneal endometriosis with evidence that it might have been metastatic from the latter. In the third the exact condition of the pelvic organs was not ascertained. (See Cases 6, 7 and 8.)

portion are superficially situated and thus readily exposed to this invasion. We should also expect that if endometrial tissue should gain access to the uterine lymph spaces and veins through the direct invasion by the mucosa lining the uterine cavity, it might escape through vessels in the upper portion of the broad ligament. Some of these vessels extend along the round ligaments to the groin. Let us see to what extent the three cases of inguinal endometriosis about to be reported support the metastatic theory as to the origin of this tissue in the groin.

CASE 6 (No. 1 of inguinal endometriosis).—Endometriosis in the left groin associated with and possibly secondary to a peritoneal endometriosis, with im-

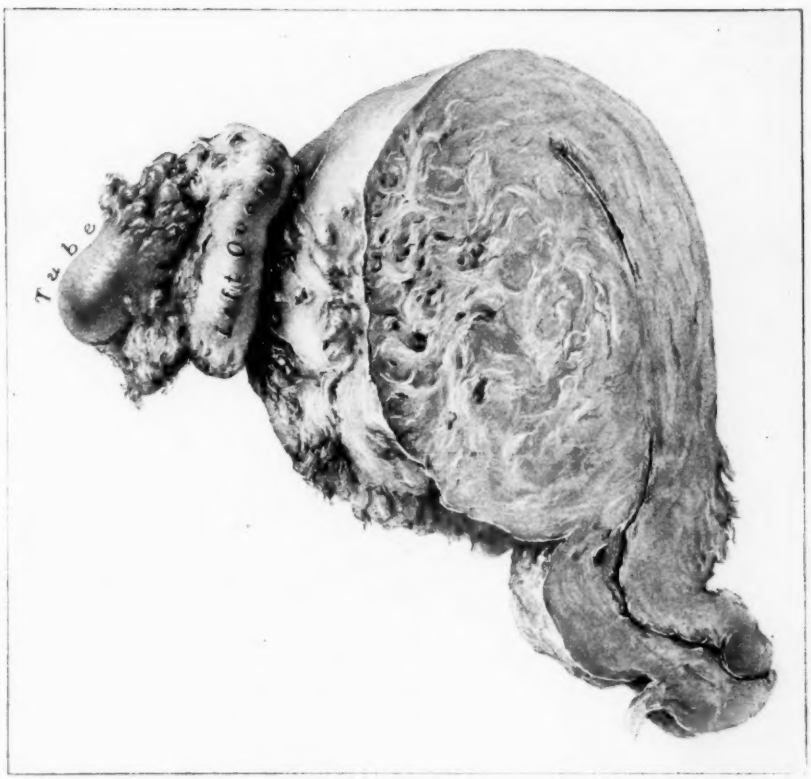

Fig. 28.—Case 6. Peritoneal endometriosis involving the left ovary, the left tube, the uterine end of the left round ligament, and the uterus, associated with endometriosis of inguinal tissue near the terminal portion of the left round ligament. View of a sagittal section of the uterus, to the left of the median line, and also of its posterior surface and the left tube and ovary (X⅝). The left tube and ovary are adherent, but the tube is patent. The posterior surface of the uterus is roughened from the endometrial tissue growing upon it and also from the trauma of freeing the uterus from the sigmoid to which it was adherent. The posterior wall is thickened due to its reaction against the endometrial tissue apparently invading it from its peritoneal surface. No evidence is found of invasion of the uterine wall by the mucosa lining its cavity. (May have been missed.)

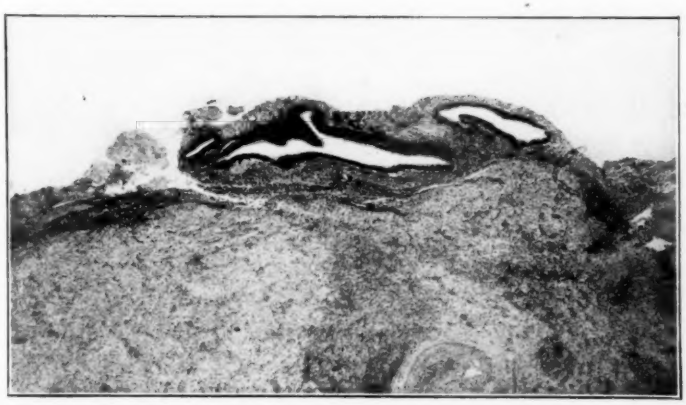

Fig. 29.—Case 6. Photomicrograph (X25) of endometrial tissue implanted on the surface of the left ovary.

plantations on and invading the left tube and ovary and especially the left half of the body of the uterus, including the uterine end of the left round ligament. The patient, unmarried and aged forty-seven, complained of pain in the lower left side of the abdomen and a nodule in the left groin. Menstruation was regular, moderate in amount and painful. The last menstrual flow occurred eight days

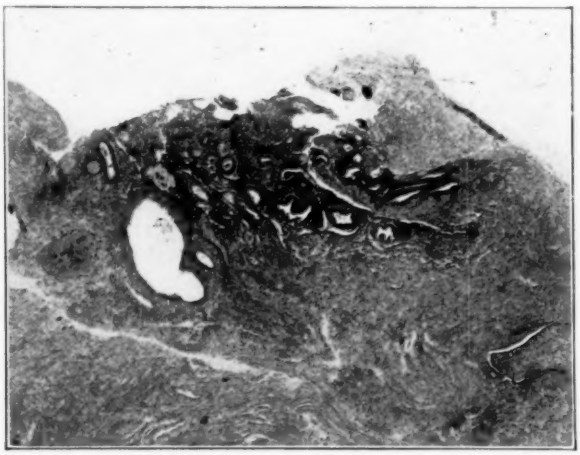

Fig. 30.—Case 6.—Photomicrograph (X25) of endometrial tissue implanted on and invading the left tube.

before the operation. She thought that the pain in the lower left side of the abdomen and the nodule in the groin appeared at about the same time and were of at least two and possibly three years' duration. The nodule had increased in size very slowly and was distinctly tender and seemed larger during her

Fig. 31.—Case 6. Photomicrograph (X5) of sagittal section through the left uterine cornu including the tube and the uterine end of the left round ligament. Endometrial tissue had apparently become implanted in the natural depression back of the tube and also between it and the round ligament with invasion of the latter and the outer zone of the uterine wall. For higher magnification of implant (*end.*) see Fig. 32 and for a better demonstration of the condition about the uterine ends of the left tube and round ligament see Fig. 34.

menstrual period. (This latter information was obtained after the operation, when the exact nature of the nodule was ascertained.) The nodule in the groin occupied the region of a left inguinal hernia, was hard and apparently fixed in position, but not adherent to the skin over it. Pelvic examination demonstrated

Fig. 32.—Case 6. Photomicrograph (X25) of the endometrial implant (*End.* Fig. 31) and its invasion of the uterine wall. The endometrial tissue of the implant (to the left) was found to be continuous with that of the upper islet of endometrial tissue in the uterine wall.

that the uterus was a little enlarged, slightly retroverted in the left side of the pelvis, and apparently adherent. The preoperative diagnosis was an adherent myomatous uterus. The nodule in the groin was thought to be an enlarged gland or a hernia. The operation occurred at the Albany Hospital, June 1, 1920. A

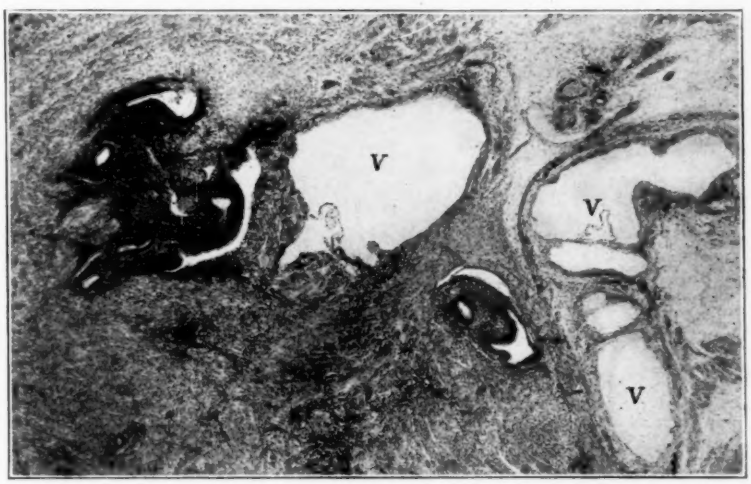

Fig. 33.—Case 6. Photomicrograph (X25) showing the proximity of endometrial tissue to lymph vessels of veins (*V*) in the uterine cornu beneath the tube and near the base of the left round ligament. (It is often difficult to decide whether a given vessel is a lymphatic or a vein.) The larger mass of endometrial tissue gives the impresison of having invaded and nearly filled the lumen of a vessel.

median incision was first made. The uterus was found to be slightly enlarged and firmly adherent by its posterior surface to the sigmoid. Before disturbing the pelvic contents the nodule in the groin was excised. It was situated just below the external abdominal ring and was densely adherent to the surrounding tissues. The round ligament was not observed during the operation nor were any lymph nodes removed. The appendix, both tubes and ovaries, and the entire uterus

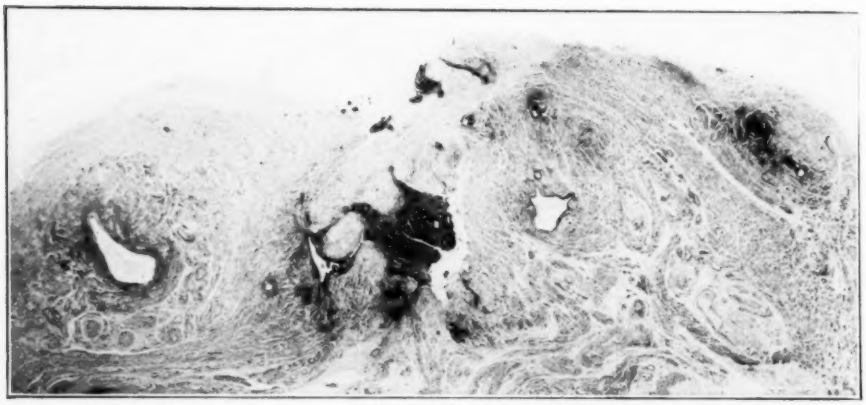

Fig. 34.—Case 6. Photomicrograph (X7) of a section through the uterine end of the left tube and round ligament. The tube (to the left) is shown in cross section. The round ligament (to the right of the midline) is invaded by endometrial tissue presenting the appearance of a cross section of the tube. The depression between the tube and the round ligament is filled with endometrial tissue and adhesions resulting from the reaction against this tissue. In the inguinal tissues about the distal end of this round ligament endometrial tissue was also found (Fig. 35).

The endometriosis of the uterine end of the left round ligament is but part of a peritoneal endometriosis involving the left ovary, the left tube, uterus, and probably the sigmoid. The character and distribution of these lesions were those of implantations arising from the escape of endometrial tissue into the peritoneal cavity, either from menstrual blood escaping through the tubes or from endometrial tissue reaching the surface of the uterus from a primary uterine endometriosis which was missed.

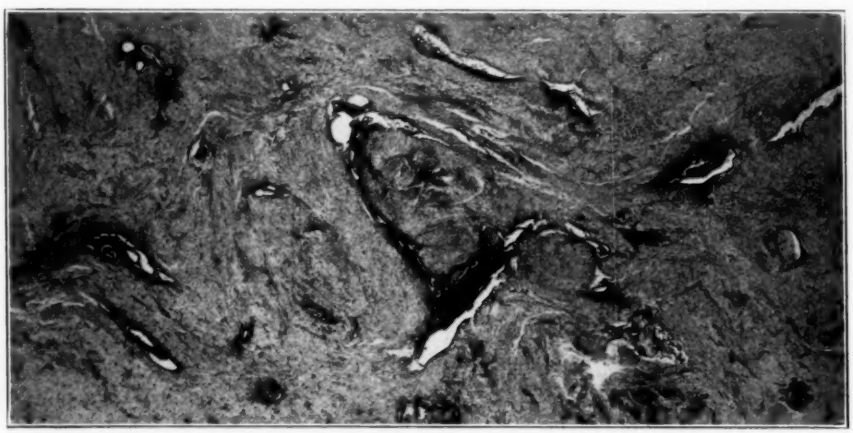

Fig. 35.—Case 6. Photomicrograph (X10) of a portion of the nodule removed from the left groin near the terminal portion of the round ligament. The histologic structure of its endometrial elements is the same as that of those found in the uterine wall arising from the direct invasion by its mucosa. The tissue about these endometrial elements consists mainly of connective tissue with very little smooth muscle. It is but a hyperplasia of the tissue normally present in this region. I believe that the endometrial tissue might have reached its present situation by metastasis through lymph vessels or veins accompanying the round ligament. See Figs. 33 and 34.

were removed. The patient made a satisfactory convalescence and has remained well.

The nodule was about 3 centimeters in its greatest diameter, firm and, on incising it, presented the gross appearance of an "adenomyoma." Its histologic structure was identical with that of an "adenomyoma" of the uterine wall, except that the predominating tissue about the endometrial islets was connective tissue and not muscle. It was classified as an "adenomyoma" of the terminal portion of the left round ligament on account of its situation and because similar growths in similar situations had been so classified in the literature. The right tube and ovary appeared normal and were free from adhesions. The left tube and ovary also appeared normal except for adhesions. The uterus was slightly enlarged, the enlargement being asymmetrical and most marked to the left of the median line. The posterior surface was roughened due to freeing it from the sigmoid, to which it had been adherent. Adhesions were present about the left uterine cornu and about the uterine origin of the left round ligament. The

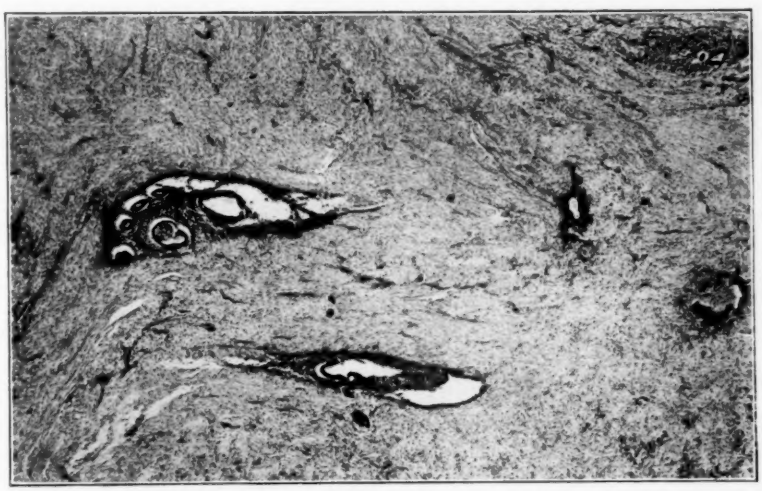

Fig. 36.—Case 6. Photomicrograph (X25) of a portion of the section shown in Fig. 35. The histologic structure of the endometrial elements is the same as that of those in the endometriosis of the uterine wall, and of the uterine end of the left round ligament (Figs. 31, 32 and 34). As shown by special stains the tissue about these endometrial elements consists mainly of connective tissue with very little smooth muscle. The latter was possibly derived from blood vessels.

right half of the uterus appeared normal. The uterus was incised through its anterior wall. The cavity appeared normal. The specimen was hardened in formalin. The gross appearance of sections of the uterine wall after fixation was that of an "adenomyoma" occupying the posterior uterine wall about the left uterine cornu, developing in the peripheral portion of the uterine wall and not connected with the mucosa lining the uterine cavity. There was no gross evidence of such an origin, nor was it demonstrated in the histologic study of sections made of portions of the uterine wall which had been most deeply penetrated by the growth. A fresh sagittal section was made through the most prominent portion of the uterine enlargement and the left half of the uterus, together with its tube and ovary, was mounted as a museum specimen (Fig. 28) of an "adenomyoma" of the uterus. The rest of the specimen from which tissue had been removed for histologic study was not saved. I believed at the time that the endometrial tissue in the uterine wall had probably arisen from the direct invasion of

the uterine mucosa and that I had missed this connection and such an invasion or even metastases from the uterine mucosa cannot be eliminated in this case. Two years later, after I had observed my second case of endometrial tissue in the groin and also had had an opportunity to become better acquainted with peritoneal implantations and the subsequent invasion of the underlying tissue, I studied the specimen from this standpoint. The sections which had been first studied were from blocks taken to demonstrate the invasion of the uterine wall by the mucosa lining its cavity and also from the right tube and ovary and right half of the uterus, which appeared normal. The sections taken two years later were from blocks of tissue removed from the

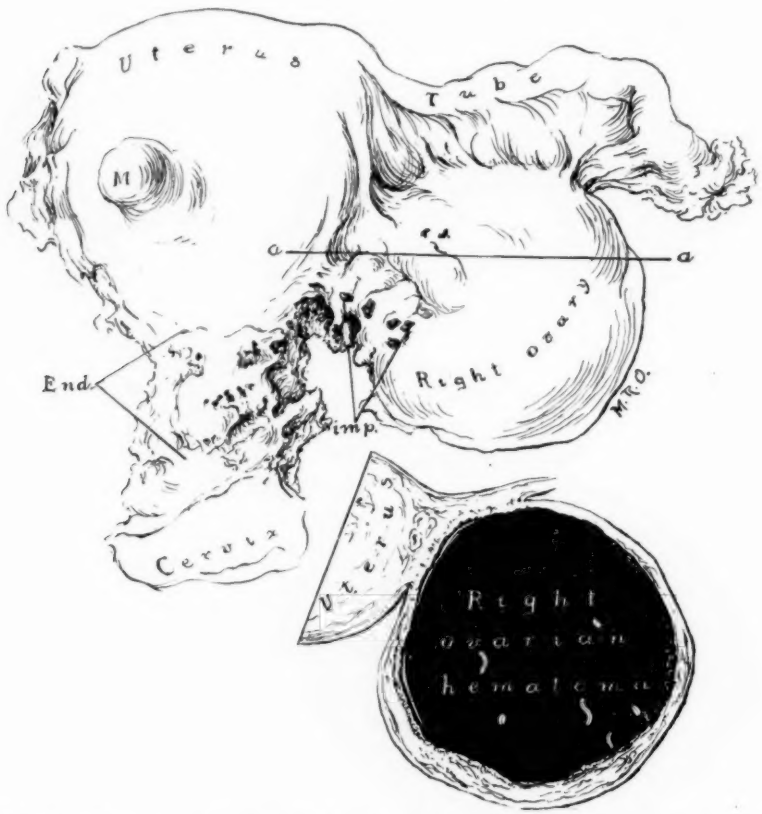

Fig. 37.—Case 7. Peritoneal endometriosis involving the posterior wall of the supravaginal portion of the cervix and the right ovary, giving rise to an ovarian hematoma or cyst which was fused with the posterior surface of the broad ligament and side of the uterus as the result of a perforation of the hematoma or from the simultaneous involvement of these structures by implanted endometrial tissue. Endometrial invasion of the uterus and right broad ligament (Figs. 42 and 43), associated with endometriosis of the inguinal tissues about the terminal portion of the right round ligament (Figs. 44 and 49). Posterior view of the uterus and right tube and ovary with insert of a cross section of the right ovary and portion of the uterus and broad ligament through the plane *a-a* (X⅝). The endometriosis of the supravaginal portion of the cervix is indicated by the pointers *End.* (Fig. 38), and implantations on the surface of the ovary by pointers *Imp.* (Fig. 40). A small subserous leiomyoma *M* is present on the posterior surface of the uterus. Both tubes were apparently normal and patent.

left tube and ovary and the left half of the uterus to demonstrate endometrial tissue possibly implanted on the surface of those organs and its invasion of the structures beneath it. Endometrial tissue was found on the surface of the left ovary (Fig. 29) on the peritoneal surface of the left tube (Fig. 30) and on the

surface of the uterus. The greater portion of the left half of the posterior surface of the uterus was superficially invaded by endometrial tissue apparently developing or implanted on its peritoneal surface. This was especially evident in the natural pockets and depressions on the surface of the uterus, such as the junction of the uterine wall with the posterior layer of the broad ligament, the

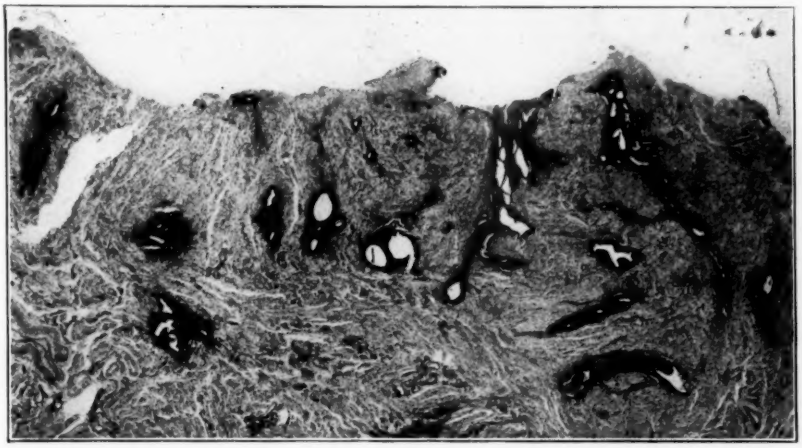

Fig. 38.—Case 7. Photomicrograph (X10) showing the endometrial invasion of the posterior wall of the supravaginal portion of the cervix, apparently from its peritoneal surface.

depression between the uterine origin of the tube (Figs. 31 and 32) and the ovarian ligament, and on the anterior surface in the depression between the tube and the round ligament (Fig. 34). The uterine portion of the round ligament was invaded by endometrial tissue. Unfortunately I do not know how far it

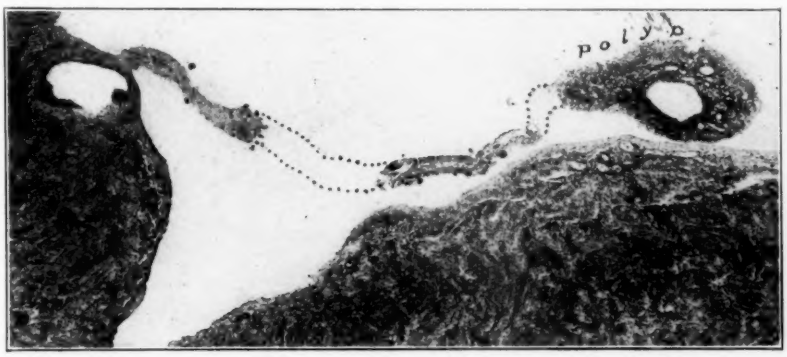

Fig. 39.—Case 7. Photomicrograph (X25) showing a small endometrial polyp (similar to that shown in Fig. 22) attached by a long pedicle to the surface of the right ovary.

extended along that structure towards the groin, as the round ligament was severed close to the uterus. The invasion of lymph vessels or veins by endometrial tissue was not definitely demonstrated in this specimen, but such an invasion was suggested (Fig. 33). I believe that the endometrial tissue in the groin (Fig. 35) might have been derived by metastasis through lymph

vessels or veins, from the endometrial tissue in the pelvis for the following reasons:

1. It had the same histologic structure as that in the pelvis.

2. It was in a situation reached by vessels extending along the round ligament termination; furthermore, endometrial tissue was found invading the tissue, possibly in vessels (Fig. 33), about the uterine end of the round ligament and also the ligament itself.

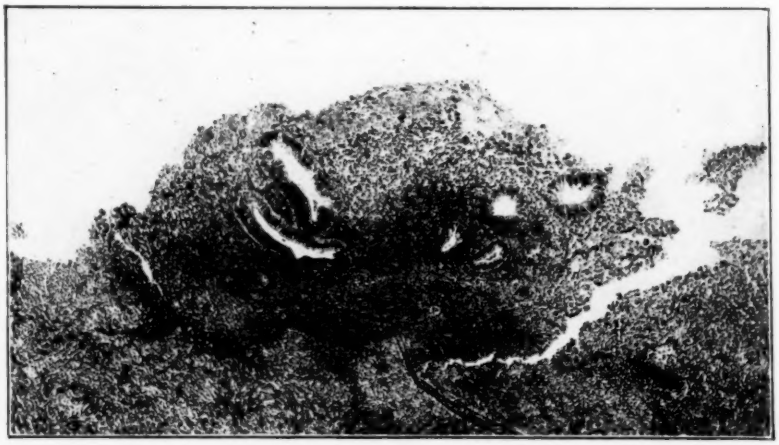

Fig. 40.—Case 7. Photomicrograph (X60) of an endometrial implant on the surface of the right ovary.

Fig. 41.—Case 7. Photomicrograph (X60) of a portion of the wall of the ovarian hematoma lined mostly by pigmented "granulation tissue" and only in places (depression of photomicrograph) by "endometrial" epithelium with a thin layer of its stroma beneath it.

3. The study of other specimens has shown the actual invasion of lymph vessels by endometrial tissue, and endometrium-like tissue has been found about, and even in, pelvic lymph nodes.

4. Metastasis from cancer in the pelvis sometimes occurs in this situation (Fig. 27).

CASE 7 (No. 2 of inguinal endometriosis).—Endometriosis in the right groin associated with and possibly secondary to a peritoneal endometriosis, the latter possibly in part due to an endometrial hematoma of the right ovary, adherent to the side of the uterus and right broad ligament, with an endometrial invasion of the uterus and right broad ligament. The patient, unmarried and aged forty-one, complained of a nodule in the right groin and painful menstruation. The latter was regular, profuse, and always painful. The pain had increased in severity in recent years and occasionally was so intense that she had to go to bed. The last menstrual flow occurred eleven days before the operation. The nodule, which occupied the situation of an inguinal hernia, was of four years' duration and its growth had been very gradual. It was distinctly tender during her menstrual flow. It was hard, fixed in position, but not adherent to the skin

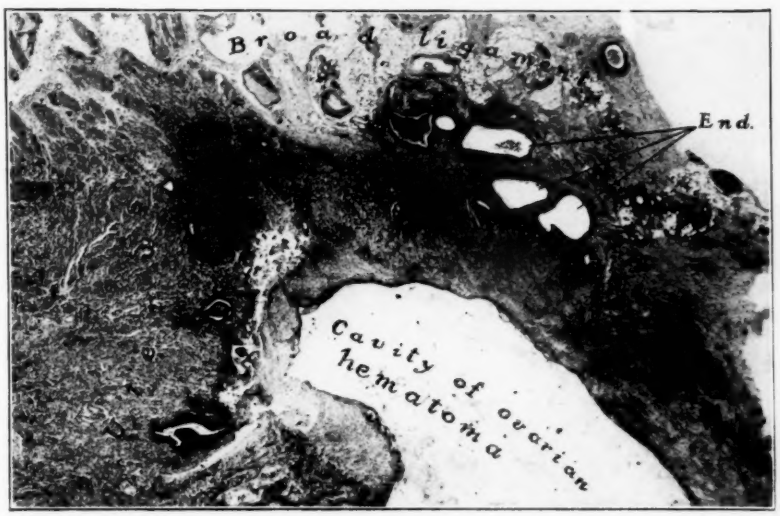

Fig. 42.—Case 7. Photomicrograph (X10) of a portion of the wall of the ovarian hematoma and uterus and broad ligament. The latter are here fused with the ovary. The endometrial invasion of the uterus and broad ligament is shown.

over it. Pelvic examination demonstrated that the uterus was retroflexed, with a nodular induration in the culdesac, and the appendages on the right side were enlarged and adherent. The preoperative diagnosis was endometrial tissue in the groin and in the culdesac and a probable endometrial hematoma of the right ovary. The operation occurred at the Albany Hospital, September 16, 1922. A median incision was made and the condition in the pelvis was first ascertained, then the nodule in the groin was excised. It was situated in the external abdominal ring and was found attached to the side of the terminal portion of the round ligament. It was removed together with a portion of the latter. The uterus was retroflexed and the fundus was not adherent, but the posterior surface of the supravaginal portion of the cervix was fused with the anterior wall of the rectum. The right ovary was enlarged and densely adherent by its lateral surface to the posterior layer of the right broad ligament. The right ovarian vessels were first ligated and severed and an attempt was made to free the ovary, together with the posterior layer of the right broad ligament, so as not to disturb

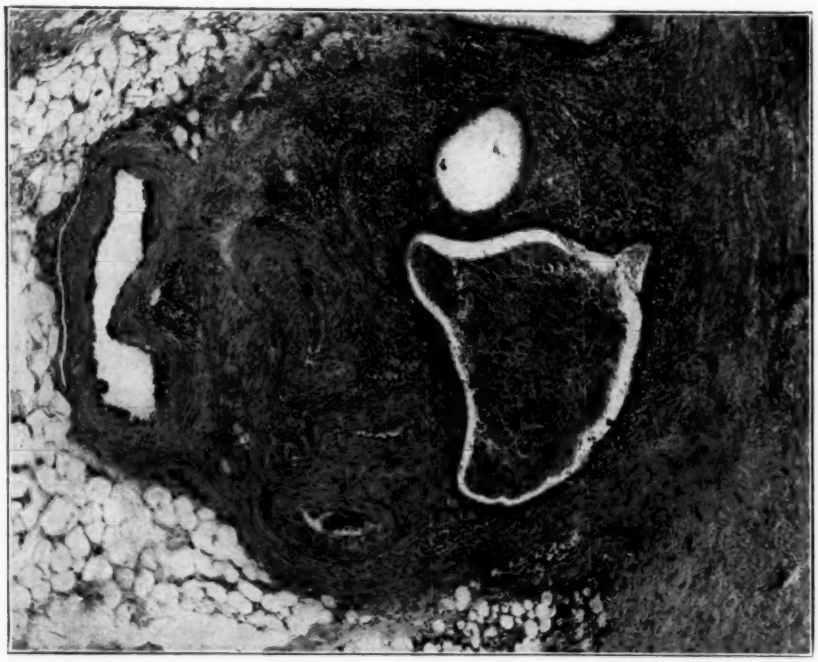

Fig. 43.—Case 7. Photomicrograph (X60) showing endometrial tubules, possibly in lymph channels, accompanying blood vessels (to the left) and situated between the layers of the right broad ligament a short distance below the right round ligament about the terminal portion of which a nodule of endometriosis was present in the groin (Figs. 44 and 49).

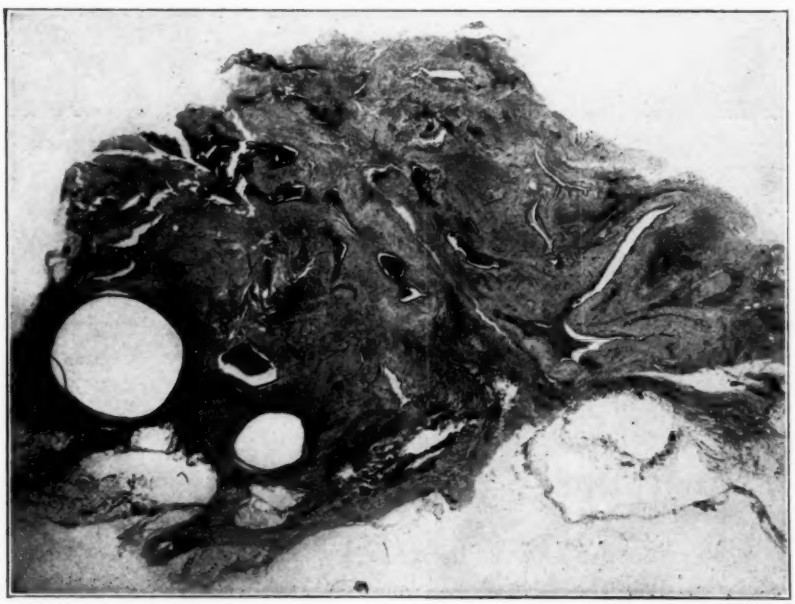

Fig. 44.—Case 7. Photomicrograph (X5) of a cross section of the nodule of endometriosis in the right groin. A mass of tissue, mostly hyperplastic connective tissue with very little smooth muscle, containing normal-sized and dilated glands and cavities (some of the latter filled with blood) and islets of uterine mucosa.

the exact relation between them. This was only partially successful, and some of the chocolate-like contents of the hematoma escaped into the pelvis. The right tube and ovary, the entire uterus and appendix were removed. The left tube and ovary, which appeared normal, were not removed. The patient made a satisfactory convalescence. A peritoneal endometriosis was present which was confined to the bottom of the culdesac, posterior wall of the cervix, the right ovary, right broad ligament, and the portion of the right side of the uterus which was adherent to the right ovary. The ovary was about 5.5 cm. in its greatest diameter and was almost entirely replaced by a hematoma. It was firmly adherent to the posterior surface of the right broad ligament and to the side of the uterus at the attachment of the bróad ligament, due to a previous perforation of the hematoma or from the simultaneous invasion of the ovary and other

Fig. 45.—Case 7. Photomicrograph (X25) of a portion of the nodule of endometriosis in the right groin, showing normal-sized and dilated glands similar to those found accompanying the blood vessels of the right broad ligament (Fig. 43), and also cavities filled with blood.

structures (Fig. 37). The hematoma was a typical endometrial one with only small portions lined by epithelium (Fig. 41). There were several minute endometrial implantations on the under surface of the ovary (Fig. 40). There was an endometrial invasion of the posterior wall of the cervix (Fig. 38) and likewise of the portion of the uterine wall adherent to the ovary. A most interesting feature was the endometrial invasion of the tissues between the layers of the broad ligament. Endometrial tissue was found accompanying the blood vessels along the side of the uterus, and possibly in lymph vessels (Figs. 42 and 43). The anterior surface of the uterus was normal and no evidence of endometrial tissue was found in sections made of the uterine end of the round ligaments. The nodule (greatest diameter about 3 cm.) in the groin was apparently attached to the side of the terminal portion of the round ligament. The gross appearance

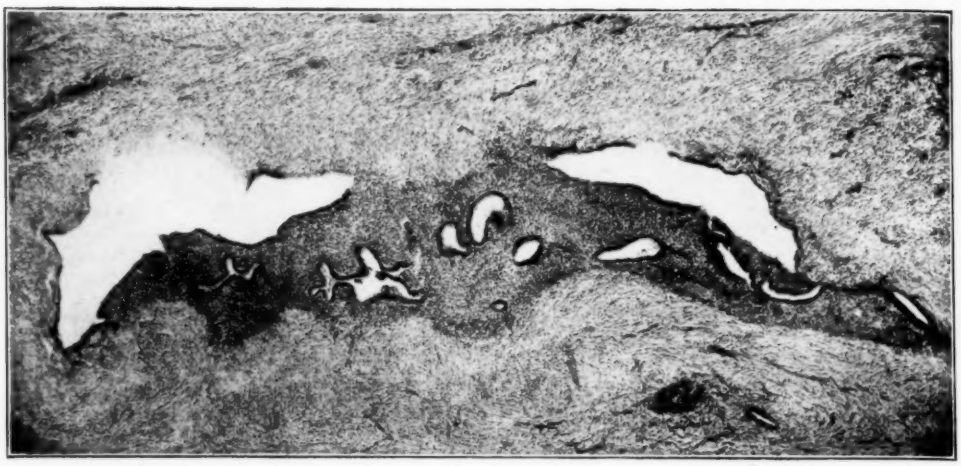

Fig. 46.—Case 7. Photomicrograph (X25) showing an islet of uterine mucosa in the nodule in the right groin. Histologically the condition in the groin and that in the pelvis are the same with anatomical indications that the process in the groin might have been secondary to that in the pelvis by metastasis through vessels accompanying the round ligament (Figs. 43 and 47).

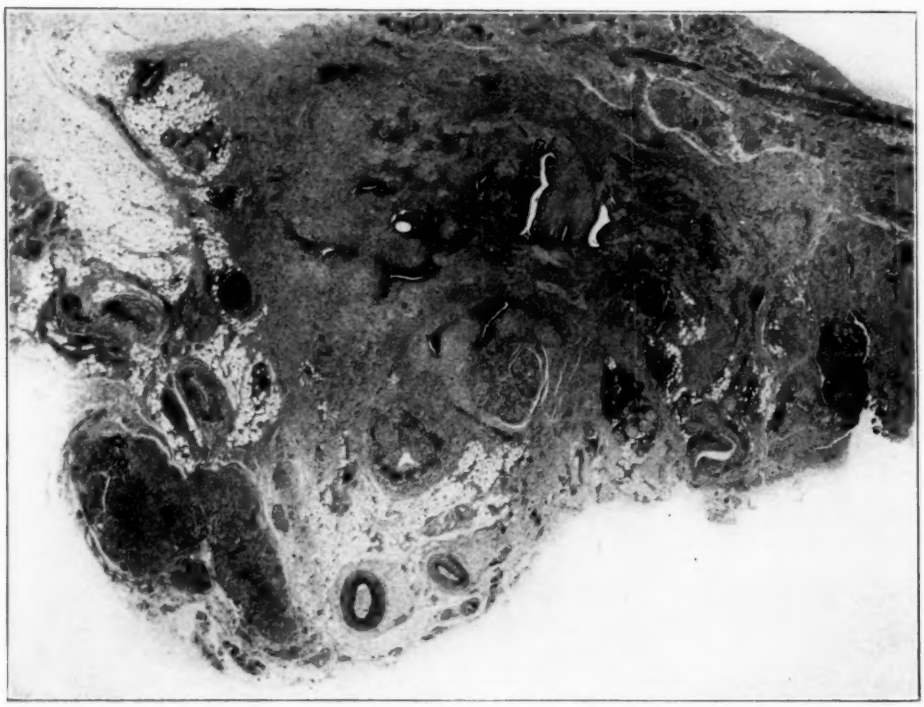

Fig. 47.—Case 7. Photomicrograph (X10) of a cross section of the terminal portion of the round ligament and the upper pole of the nodule in the groin demonstrating that the endometriosis has developed in tissues (possibly in lymph vessels) lateral to the round ligament.

of the specimen gave one the impression that the growth had developed in the inguinal tissues about the terminal portion of the round ligament and that the latter had become adherent to it (see Figs. 47 and 48). The gross appearance of the surface of a section of the hardened specimen was that of sections of an "adenomyoma" with dilated spaces filled with menstrual blood (Fig. 49). The histologic structure of the endometrial tissue in the growth was identical with that found in the so-called adenomyomas arising from the invasion of the uterine wall by the mucosa lining its cavity. There were also many spaces lined by cuboidal cells and without any endometrial stroma about them. Some of these were distended and filled with blood and others were collapsed and might have been filled with blood before the growth had been removed (Figs. 44, 45 and 46). At first I thought that they were all dilated endometrial cavities and lately I have considered that some of them at least, might be lymph spaces. The framework of the "growth" consisted mostly of hypertrophied connective tissue with

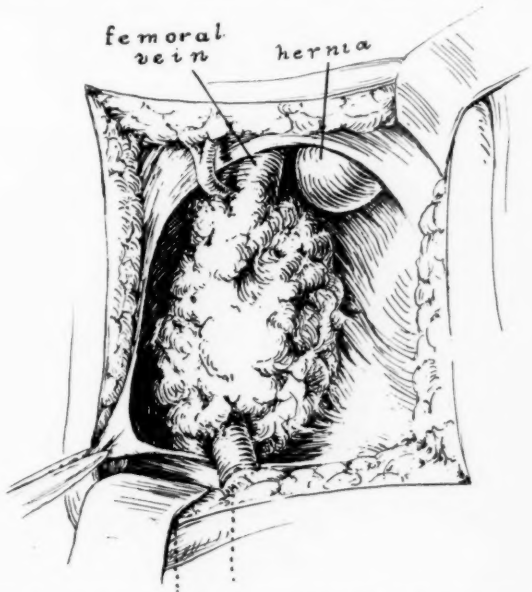

Fig. 50.—Case 8. Inguinal endometriosis involving the tissues about the right femoral vein (X⅝). The source of the endometrial tissue was not ascertained. The pelvic organs were inspected, but not removed. There was not any gross evidence of peritoneal endometriosis. The uterus was slightly enlarged with a small intramural "leiomyoma" of the right side. If the endometriosis arose from tissue derived from the mucosa lining the uterine cavity it must have reached its inguinal situation as a metastasis through vessels which had been invaded by this tissue as a part of a direct uterine endometriosis or from endometrial tissue gaining access to these vessels during menstruation. The nodule was firmly adherent to the anterior surface of the femoral vein. A femoral hernia was present, apparently not connected with this nodule and its sac did not contain any endometrial implantations.

very little smooth muscle. While the nodule was definitely adherent to the side of the round ligament, I was unable to demonstrate that the muscular tissues of the latter were invaded by the endometrial tissue, nor can I absolutely exclude the same. The entire specimen was cut into blocks about 5 mm. thick and sections were made and studied from each block, but complete serial sections were not made. My impression was that the endometrial tissue had developed in lymph vessels about the terminal portion of the round ligament. Only one lymph node was removed with the specimen and this did not contain any endometrial tissue.

I believe that the endometriosis in the groin might have been secondary through metastasis by lymph vessels from a similar condition in the pelvis for the following reasons:

1. It had the same histologic structure as that in the pelvis.

2. It was in a situation in which lymph vessels extending along the round ligament terminate and the histologic structure of the tissue in the groin suggested a development in lymph vessels.

3. Endometrial tissue was found accompanying blood vessels situated along the right side of the uterus between the layers of the broad ligament and not far from the uterine origin of the right round ligament about the distal end of which the inguinal endometriosis had developed. Tissue in this situation

Fig. 51.—Case 8. Photomicrograph (X10) of a portion of the nodule shown in Fig. 50. Its histologic structure is identical with that of the two preceding nodules of inguinal endometriosis.

may have invaded lymph vessels and been carried to the groin. Had cancer been found in the right groin and also the invasion of the right broad ligament from a peritoneal carcinosis, the relation between the growths in the two situations would not be questioned.

CASE 8 (No. 3 of inguinal endometriosis).—Endometriosis in the right groin, about and attached to the anterior surface of the femoral vein, associated with a right femoral hernia, no gross evidence of peritoneal endometriosis, uterus slightly enlarged with a small leiomyoma in its right wall near the attachment of the broad ligament. The patient, unmarried and aged thirty-three, was first seen October 27, 1920. She complained of a dull pain in the right groin. Menstruation was regular, moderate in amount, and painful. She had noticed a lump in

the right groin for two years. It had gradually increased in size and seemed larger during her menstrual flow and was tender at that time. The nodule occupied the region of a femoral hernia and had been so diagnosed. It was hard, fixed in position, but was not adherent to the skin over it. Pelvic examination

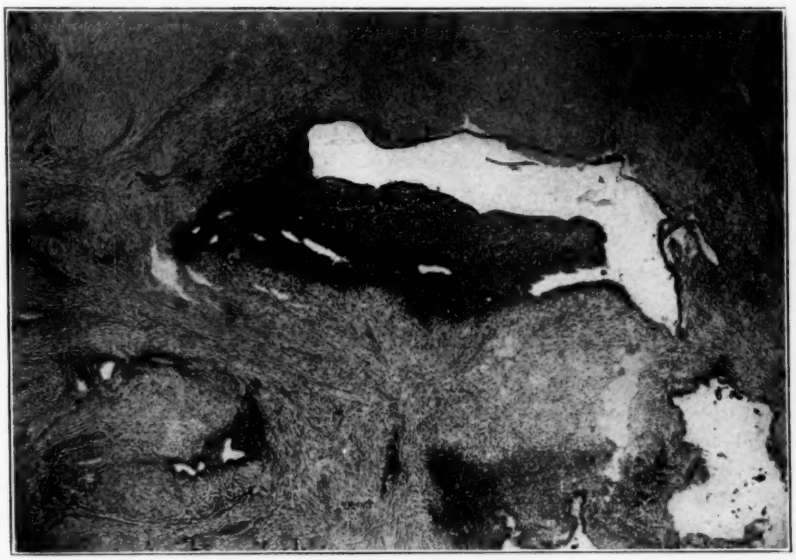

Fig. 52.—Case 8. Photomicrograph (X25) demonstrating the character of the endometrial tissue in this lesion. Compare with Fig. 46.

demonstrated that the uterus was apparently of normal size, in normal position and freely movable. The appendages were apparently normal. The diagnosis was an "adenomyoma" in the right groin. (I had operated upon the first case

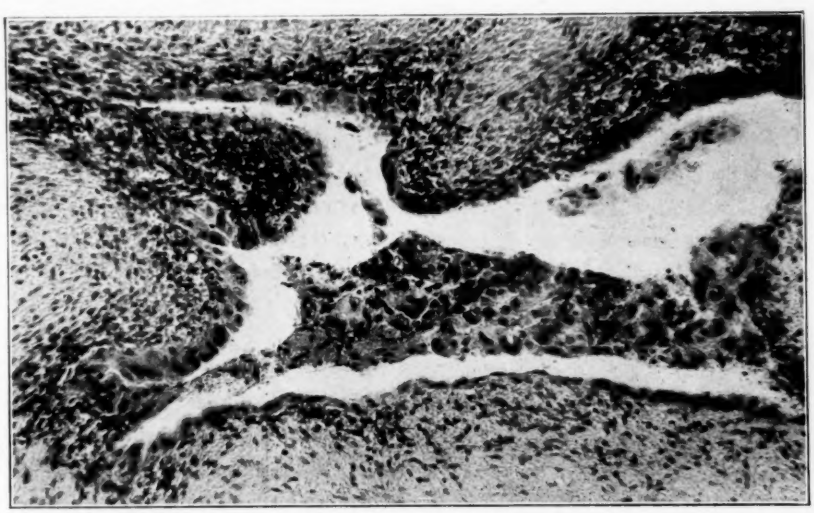

Fig. 53.—Case 8. Photomicrograph (X130) demonstrating a marked metaplasia of the epithelial lining of a dilated "endometrial" cavity, simulating early malignancy. Emanuel has suggested that cancer may arise in endometrial tissue in this situation.

only a few months before.) Its removal was advised, but refused. I saw the patient again in February, 1923. She gave the same history as before and in addition complained of indigestion, and pain in the lower right side of the abdomen. The nodule seemed a little larger and there was considerable tenderness on palpating the region of the cecum. The result of pelvic examination was the same as before. She consented to an operation, but was most emphatic in her desire for conservation of her pelvic organs. The operation occurred at the Albany Hospital, February 16, 1923, two weeks after her last menstrual period. On exposing the nodule it was found to be densely adherent to the anterior surface of the femoral vein (Fig. 50) and with great difficulty was dissected from it. A femoral hernia was also present. The hernia was repaired. The sac of the hernia was situated just above the nodule and apparently was not connected with it. No evidence of endometrial implantations was found in the sac. A median incision was made and there was no gross evidence of peritoneal endometriosis. The uterus was slightly enlarged, but otherwise appeared normal, except for what felt like a small leiomyoma on the right side and presenting between the layers of the right broad ligament; this was not disturbed. (I wished afterwards that I had removed it.) The tubes and ovaries were normal. The appendix was removed. The patient made a satisfactory convalescence. The mass of tissue removed was a little over 4 cm. in its greatest diameter, was firm, and on section presented the same gross appearance as the others. Histologically it consisted of dense connective tissue with islands of endometrial tissue identical with those found in the so-called "adenomyoma" resulting from the invasion of the uterine wall by its mucosa (Figs. 51 and 52). Ciliated epithelium was not found. Two lymph nodes were removed and were normal. The histologic structure of the inguinal growth was similar to that of the other two cases of inguinal endometriosis. Its situation was different and it was not in any way connected with the round ligament itself, but developed in the tissues about the femoral vein. I was unable to obtain any possible clue as to the inguinal tissue in which it first started. What was the source of the endometrial tissue? If metastatic, where did it come from? We naturally look to the uterus. It was slightly enlarged with a small intramural "leiomyoma" presenting between the layers of the broad ligament of the same side as the endometrial tissue in the groin. Unfortunately (from a scientific standpoint) the uterus was not removed, and it was impossible to ascertain whether or not its walls had been invaded by its mucosa.

CONCLUSIONS

In eight cases of endometriosis of the intraperitoneal portion of the round ligament (so-called "adenomyoma" of that structure) a similar invasion of other pelvic structures was also present. The distribution of these lesions was similar to that found in the implantation of cancer in peritoneal carcinosis secondary to carcinoma of the pelvic organs. In four of these cases, an endometrial hematoma of one of the ovaries was also present (both ovaries in one patient). In three others a small amount of endometrial tissue was present in one or both ovaries, without the development of an endometrial cyst or hematoma. In the remaining one, endometrial tissue was not found in either ovary. I believe that in all eight cases the peritoneal endometriosis was mainly of implantation origin, primarily from epithelium carried through the tubes during menstruation, and secondarily from the menstrual reac-

tion of endometrial foci on the surface of the peritoneum or the perforation of an ovarian hematoma. In Case 3, venous or lymphatic metastases from a possible primary uterine endometriosis may have given rise to some of the superficial endometrial lesions of the uterine wall.

In the three cases of inguinal endometriosis, the structure of the endometrial elements was identical with that of those found in the uterine wall resulting from the direct invasion of the myometrium by the mucosa lining the uterine cavity. There was a similar reaction against this invasion with a hypertrophy of tissues of the groin, the tissue reacting against the invasion being for the most part connective tissue with very little smooth muscle, as shown by the Van Gieson and by the (Mallory) phosphotungstic acid hematoxylin stains. In all three cases the nodule in the groin reacted to menstruation as was indicated by its being tender at that time and also by the presence of cavities filled with blood and blood pigment in its tissues.

In the first specimen, the nodule was situated just below the external abdominal ring and the round ligament was not observed during the operation. In the second, the mass of tissue which had reacted to the endometrial invasion was adherent to the side of the terminal portion of the round ligament, but I was unable to demonstrate the actual invasion of that structure by endometrial tissue. (Possibly missed because serial sections were not made.) This tissue had evidently primarily developed in structures lateral to the terminal portion of the round ligament. In the third specimen, the endometrial tissue occupied the region of a femoral hernia and was densely adherent to the anterior surface of the femoral vein. None of these three cases could be classified as a "tumor" of the round ligament, although I believe that in all of them the endometrial tissue might have reached the groin through vessels accompanying the round ligament.

In the first case, peritoneal endometriosis was present. There was an endometrial invasion of the uterine end of the round ligament and the structures about it on the same side as the endometrial tissue in the groin near the distal end of that ligament. In the second, peritoneal endometriosis was also present with an invasion of the broad ligament of the same side as the endometrial tissue in the groin.

In the third case, gross evidence of peritoneal endometriosis was not present. The pelvic organs were inspected, but not removed (see case report). The uterus was slightly enlarged with a small leiomyoma presenting between the layers of the broad ligament of the same side as the endometrial tissue in the groin. The possibility of metastasis through lymph channels or veins reached by the invasion of the uterine wall by its mucosa must be considered in this instance, i.e., from a primary uterine endometriosis or from endometrial tissue escaping into uterine vessels during menstruation.

A study of the whole subject of pelvic endometriosis suggests that at times metastasis occurs through the lymph vessels and possibly through the vein and that endometrial tissue may reach the groin and other parts of the body through these channels. Future studies will demonstrate the truth or fallacy of this interpretation.

I believe that we are warranted in stating that possibly inguinal endometriosis may be secondary to that in the pelvis and, if so, that it may arise from: 1. Metastasis through lymph vessels invaded by endometrial tissue implanted about the uterine end of the round ligament and the broad ligament. 2. A direct extension or metastasis along the round ligament from a peritoneal endometriosis about the abdominal inguinal ring. 3. Metastasis from the direct invasion of the uterus or tube by their mucosa with extension to the superficial lymphatics and veins and also from endometrial tissue escaping into uterine vessels during menstruation. 4. Implantations in a hernial sac.

NOTE: As this article is going to press I am studying the material from a fourth case of inguinal endometriosis, the operation occurring July 3, 1925. The patient had an endometrial hematoma of the left ovary and associated with it a peritoneal endometriosis with endometrial tissue invading the structures about the right internal abdominal ring. The patient had had a right inguinal hernia for two years which had been "irreducible" the last four months. A peritoneal endometriosis was also present in the walls of the hernial sac and the neck of the latter was occluded by the reaction against the endometrial tissue invading the structures forming its lumen. I believe that the inguinal endometriosis arose from the implantation of endometrial tissue in the sac of a right inguinal hernia.

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(*For discussion see page* 595.)

AN ILLUSTRATED HISTORY OF THE LOW OR CERVICAL CESAREAN SECTIONS*

By Joseph B. De Lee, M.D., Chicago, Ill.

THE history of the cervical cesarean section teaches that the principles of the low incision were established at the very beginning, and that the present perfection of the operation is the result of the development of our knowledge of the local anatomy, plus, of course, the improvement in surgical technic and anesthesia. It will, therefore, be very helpful to the understanding of the different operations if the regional anatomy is studied.

Particular notice is to be taken of the extreme mobility possessed by the peritoneum over the bladder and lower uterine segment, and how this portion of the uterus is almost denuded of the serous membrane, becoming largely extraperitoneal. The changes in location of the anterior culdesac may be compared to those produced by a cervical subserous fibroid, developing to the size of a fetal head.

Mythology abounds with instances of cesarean section on the dead mother. The removal of the child after the death of its mother was the Lex Regia of Numa Pompilius, 700 B.C. References to section on the living woman are only of recent date, mainly since 1420, but we have strong reasons for believing that it was practiced long before Christ. One would not expect anatomic details of the operation to come out of antiquity, but we may well believe, from references in ancient literature, that several methods were practiced, even in those days.

It is claimed that Buddha was delivered through the flank of his mother, that Brahma appeared through the navel, and the Babylonian Jews in the Mischnejoth (140 B.C.) described two kinds of cesarean section, the Kariyath Habeten, similar to our classic operation, and the Jotze Dofan or flank delivery which may have been the operation of Ritgen (1821), Thomas (1870), and A. B. Davis (1924). The Jews,

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according to Preuss, did the operation on the living patient long before the first authentic case of Trautman (1610), indeed even before the present era, as is evidenced by rabbinic laws regarding women who had had abdominal delivery and regarding the rights of twins delivered by section. The rabbis believed such women were sterile thereafter. (See Rigby, Macht, Schapiro.)

That there were, even before Christ, several varieties of cesarean section is certain and it may be assumed that these different modes of operating were dictated by the deadlines of the interference. Death was the usual outcome and it was due to hemorrhage or peritonitis, both the result of imperfect closure of the uterine wound. The spongy vascular uterus could not contract, nor stay contracted long enough to control bleeding, and the lochia almost always were discharged through the abdominal aperture, usually accompanied by a fatal peritonitis. Further, there was danger from the primary spill, and, in those days laparotomy technic was poor; they had no anesthetics, and the escape of bowels and omentum created serious operative complications.

The first to actually make a purposeful, scientifically thought-out attempt to circumvent all these dangers was Osiander, of Goettingen, in 1805. In my opinion, formed by reading his original descriptions of his two operations, he is entitled to the credit of being the first to blaze the way to the modern low cesarean section.

It was the nineteenth of March, 1805. The day had been a strenuous one in the hospital, there having been three unusually difficult deliveries and, before attempting the cesarean section, Osiander took a half hour's rest. During this time he revolved in his mind the disadvantages of the methods of section in vogue at the time and thought out the technic soon to be described. He argued, (1) that experience with rupture of the uterus proved that the danger was less when the tear occurred in the lower half than when it fell in the upper part, or indeed the middle,—meaning the dangers of hemorrhage and sepsis; (2) the incision in the belly and the uterus could be smaller,—a decided advantage as regards hemorrhage and infection in those nonaseptic days, and as a preventive of escape of the intestines during operation; (3) the wound being in the lower half of the uterus would sink deep down into the pelvis behind the pubis. Thus, blood and liquor amnii would not get into the general peritoneal cavity, the lochia would be provided ready escape, and at the same time gut and omentum would not so easily find their way into the uterine aperture and prevent healing. Resolution followed these deliberations and he put his plan of operation into effect. The patient, who bore her suffering stoically,—not even having her hands tied down,—died of per-

itonitis, as did another woman operated on according to the same method, a year thereafter.

At both operations, Osiander found these true obstetric principles vindicated, and although success failed him we can partly agree with the original and intrepid operator that the bad result was not due to the method but to the poor subjects he had,—both half-starved human flotsam, covered with vermin and pustular eruptions.

Before enumerating the cervical operations, it may be well to remind the reader that the knowledge of the anatomy of the uterus and cervix possessed by those older accouchers was meager, and that the distinctions (late in labor) between vagina, cervix, lower uterine segment, and uterine body were not as carefully drawn as is possible today. Since all their operations were done during very advanced labor, when the cervix and lower uterine segment were one canal and dilated and stretched to the utmost, we may conclude, with a high degree of certainty, that their incisions were made as often in the cervix as the vagina, and most often in that portion of the parturient canal we call the lower uterine segment, or isthmus. This fact was appreciated by Osiander in 1812 (l. c., vol. iii, 75).

In performing his operation Osiander pushed the head up against the lower abdominal wall with one hand in the vagina, and, with the other, he cut down on the bulging prominence making his incision alongside the pyramidalis muscle. The head popped out through the opening, responding to the pressure from behind, and the body then quickly emerged; soon thereafter the placenta followed, whereupon the uterus sank into the pelvis carrying the wound so far down that it disappeared from view. There can be no doubt from his description but that this was a true laparotrachelotomy. (Fig. 1.)

Joerg, of Leipzig, in 1806, basing his recommendations on the clinical observation reported by Boër, that rupture of the vagina (and probably the lower uterine segment) allowed the exit of the child into the peritoneal cavity from which it could be easily removed, suggested that at cesarean section, instead of opening the middle of the uterus, the incision be made in the vagina and, if there is not room enough, the mouth of the uterus also, thus providing an opening for the extraction of the child. Fig. 2. Or in Joerg's own words:

"Könnte nicht vielleicht auch beym Kaiserschnitte die Mutterscheide, und wäre dies allein nicht hinreichend, der Muttermund zugleich mitgeöffnet und das Kind durch diese Oeffnung aus der Gebärmutterhöhle geschafft werden? Vermuthlich würde durch diese Veränderung des Einschnittes diese Operation weniger gefährlich werden, als sie ist, wenn die Gebärmutter in der Mitte geöffnet wird.—Ich bin erst seit kurzer Zeit auf diese Idee gekommen, und habe daher noch keine Gelegenheit gehabt, Versuche anzustellen; ich bitte aber Geburtshelfer, die Gelegenheit haben, im letzten Monate der Schwangerschaft verstorbene Schwangere zu seciren, recht sehr, auf die Beantwortung meiner Frage mit Rücksicht zu nehmen."

It is in the last of his "Aphorisms," in a tiny unimportant booklet on sundry obstetric subjects, that Joerg expresses his belief in the possibility of such an operation and requests surgeons to try it out on women dead in late pregnancy. Very lukewarm himself regarding its advantages over the classic cesarean, he did not perform the operation on the living, but, in the 1820 edition of his textbook, mentions having done it once on a dead parturient. He did not urge it upon the profession as Osiander did,—indeed, the latter said it should replace the classic section entirely, so deeply was he convinced of the superiority of the low operation.

Osiander antedated Joerg by one year and possibly Joerg got his

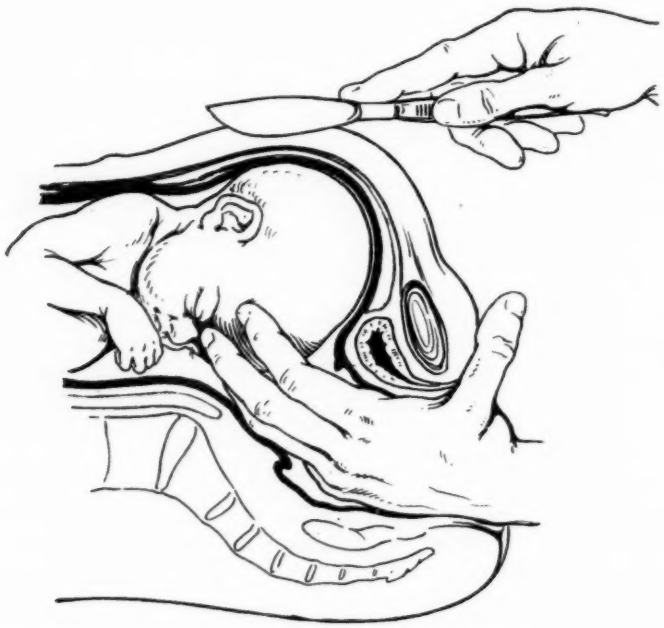

Fig. 1.—Osiander's operation, 1805. (In this and the following cuts, the peritoneum is shown in red.)

idea from Osiander. Osiander preserved the torso of his first patient and demonstrated it regularly in his obstetric lectures. Leipzig is 125 miles from Goettingen.

In those days of universal infection there was a great clamor from many sides against opening the serous cavities. It was believed that laparotomy was almost invariably followed by peritonitis. This was contested by a few, even then, and now we have learned that the peritoneum can care for much infection. Abernethy, in 1796, ligated the internal iliac artery extraperitoneally and, by the surgeons, this method of approach to abdominal organs was adopted wherever feasible.

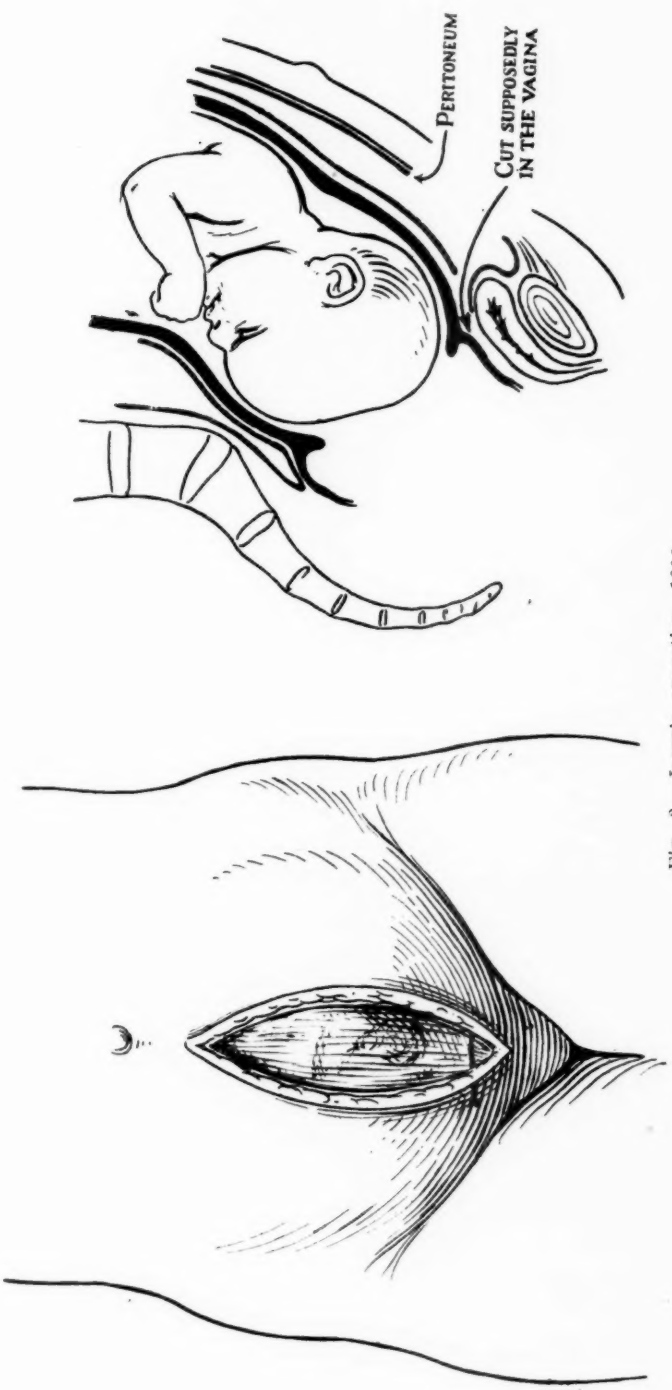

Fig. 2.—Joerg's operation, 1806.

Ritgen, of Giessen, in 1821, following this line of reasoning, tried to reach the vagina by an incision parallel to Poupart's ligament, operating subperitoneally, thus to empty the parturient uterus. He failed through lack of anatomic knowledge, which caused profuse hemorrhage. (Fig. 3.)

In 1823, Baudelocque, the younger, devised, independently, a new method of abdominal delivery. Whereas his uncle, in 1790, had expressly warned against incising the neck of the uterus and had insisted on the opening being made at least 2 inches above the internal os,—the idea being to make the aperture in the uterus to correspond to that in the abdomen and thus provide for the free exit of the lochia,—the nephew devised two low operations for removing the child abdominally. One was similar to Ritgen's, the other the same in all respects but that the approach to the vagina was made through the peritoneal cavity. Both his patients died, one from hemorrhage, one from peritonitis. He named these operations gastroelytrotomy and twenty years later wrote a paper denouncing them.

In 1824, Physick, of Philadelphia, through the agency of a letter written by Dr. W. A. Horner, recommended to Dewees a true extraperitoneal cesarean section. Neither performed it. One should make a cross cut through the abdominal wall just above the pubis down to the peritoneum; the serosa is then to be elevated off the bladder by dissection; one thus gains access to the cervix and another cross cut here enables the delivery to be accomplished. (Fig. 4.)

With the exception of a case of combined Ritgen and Joerg operations reported by Testa as having been performed by Cianflone in Italy, oblivion was the fate of these recommendations and attempts to make cesarean section safe. Looking backward, one would expect nothing else. Success had to wait on more knowledge. Antisepsis and asepsis had to come; pelvic anatomy had to be learned; anesthesia had to render deliberate operating possible; and surgical technic had to be developed.

In 1870, T. Gaillard Thomas, of New York, revived Ritgen's gastroelytrotomy and in spite of the crudity of the technic and the imperfect asepsis of the times, of eight operations performed up to 1878, four women lived,—Thomas 1, Skene 2, Gillette 1. This mortality, 50 per cent, was certainly as good as that of the classic cesarean section, indeed better, since in those days 40 to 80 per cent of the women died, and in some countries not one woman survived the operation in a half century. In the meantime, however, 1876, Porro, of Pavia, invented his operation which did away, almost, with the dangers of both hemorrhage and sepsis, wherefore Thomas's revival of laparoelytrotomy did not last long.

In 1881, Kehrer modified the classic section by making the incision

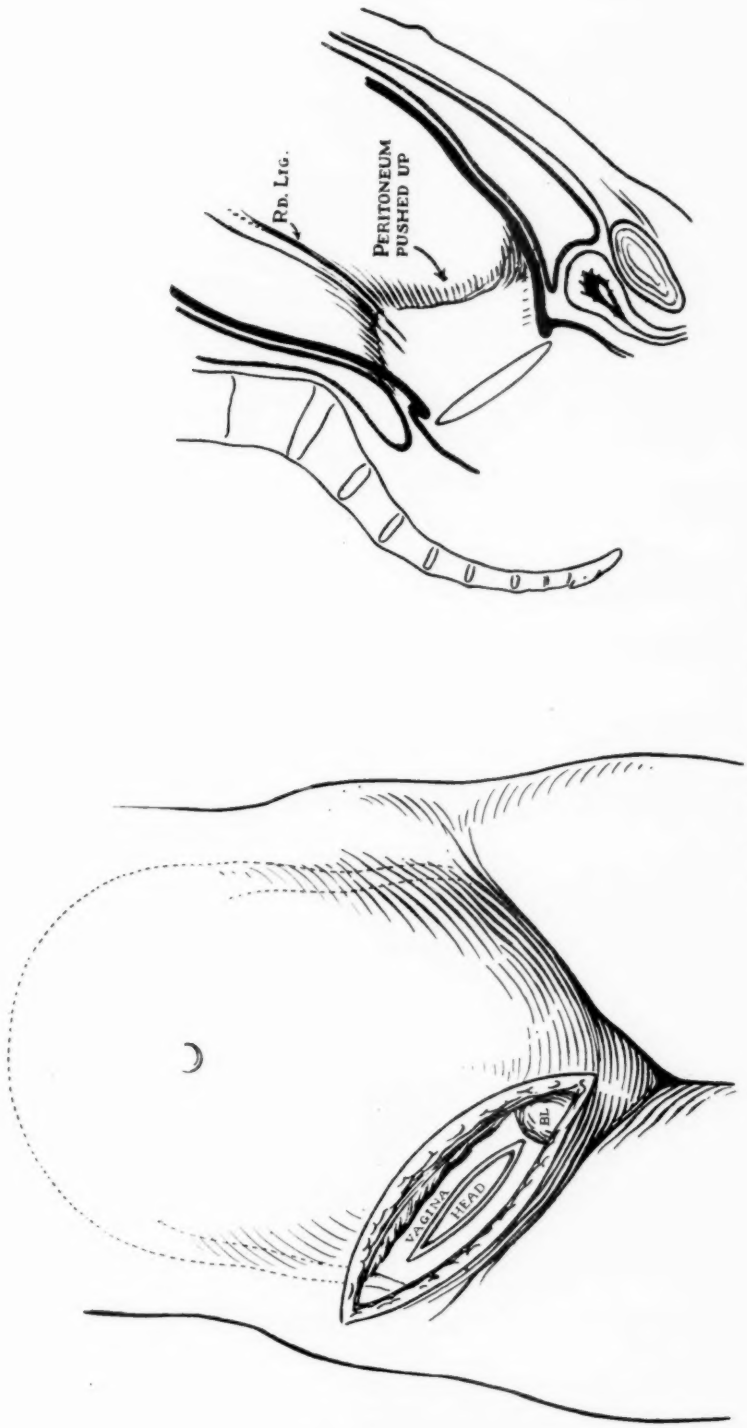

Fig. 3.—Kiltgen's operation, 1821.

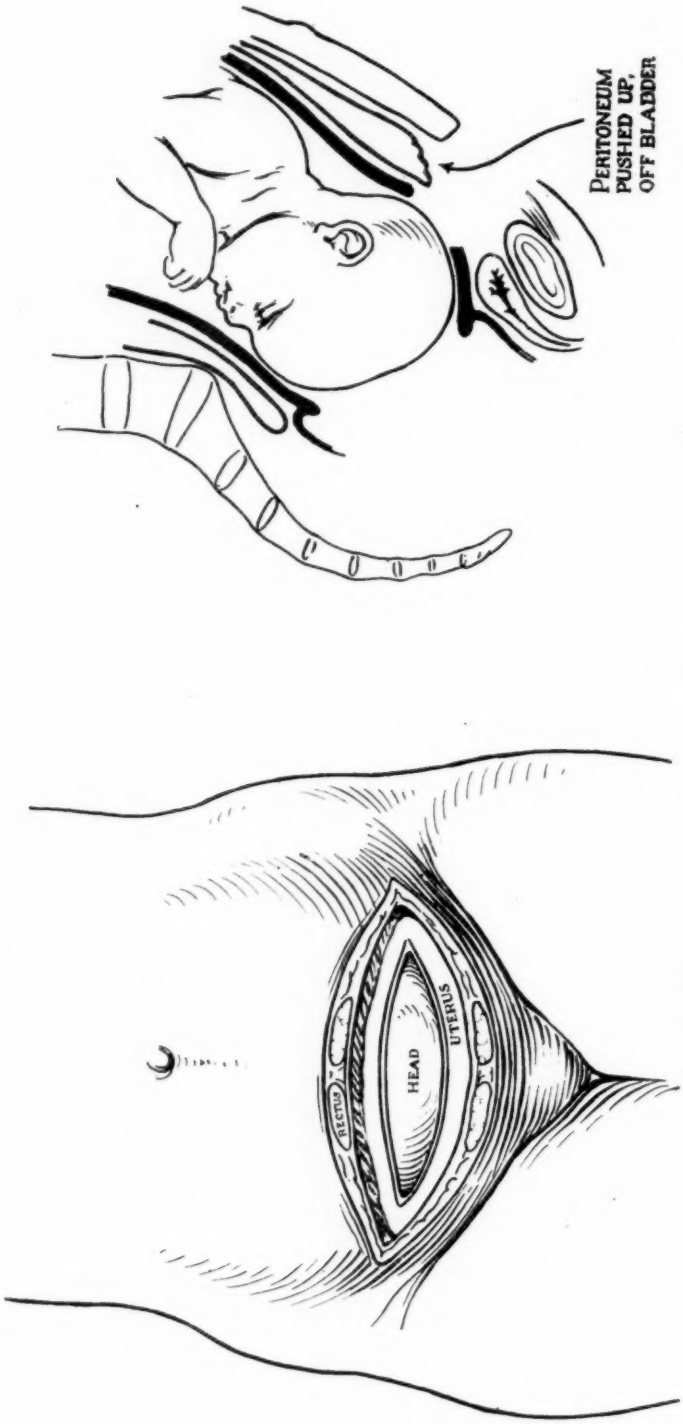

Fig. 4.—Physick's operation, 1824. Sellheim's first operation similar to this.

at the junction of the cervix with the body of the uterus and transversely. He also insisted on an accurate suture. Not enough attention was paid to this real advance in technic. Saenger's improvement of the classic cesarean, in 1882, consisted mainly of a firm uterine closure, combined with a rigid asepsis and thus the cesarean operation was freed of most of its dangers. It sprang into favor and soon became standard all over the world. The mortality sank from 65 per cent to 30 per cent, to 20, 10, 5,—indeed series of 100 or more cases without maternal death were published. Nevertheless, the general mortality could not be reduced low enough, and it remained at nearly the old time figure in just those cases which were most common and where abnormal delivery was most needed, i.e., the neglected labor with the suspicion of infection. Furthermore, even with a low mortality, there was always a large and worrisome peritoneal morbidity.

Therefore, Fritz Frank, of Cologne, struck a responsive chord, particularly in Germany, when, in 1906, he presented to the profession an improved Osiander-Joerg-Physick operation. He made a cross cut above the pubis, through the whole thickness of the abdominal wall (Bardenheuer's incision) to the peritoneum; then he incised the peritoneum transversely across the top of the bladder and made a corresponding cross cut through the serosa over the distended lower uterine segment but near the bladder reflection; after stripping up the peritoneum from the lower uterine segment he united the upper flap of the visceral to the upper flap of the parietal peritoneum, thus shutting the general cavity off from the region above the bladder; in fact, he made a new and elevated anterior culdesac; then he opened the uterus transversely and delivered the child. The sutured edges of the peritoneum were left united and the abdomen closed with drainage. He first tried, but failed, to hold a purely subperitoneal course. In several cases he did succeed in operating extraperitoneally. Frank reported 13 operations without a death, and at once the Germans began experimenting with the new procedure. To the German operators must be given credit for having contributed the most in the development of our modern cesarean section. (Fig. 5.)

Veit and Fromme, in Halle, 1908, at first used Frank's method but took out the peritoneal suture and reunited the peritoneum as it originally was. Later, they substituted the longitudinal for the transverse abdominal and uterine incision, uniting the edges of the parietal to the edges of the undermined uterine peritoneum with clamps before opening the lower uterine segment. The peritoneal flaps were restored anatomically in the closure. Hirst, of Philadelphia, independently worked out an identical operation using sutures at first and later clamps for the temporary closure. The sutured peritoneum was not reopened but the four edges were brought together in the median line.

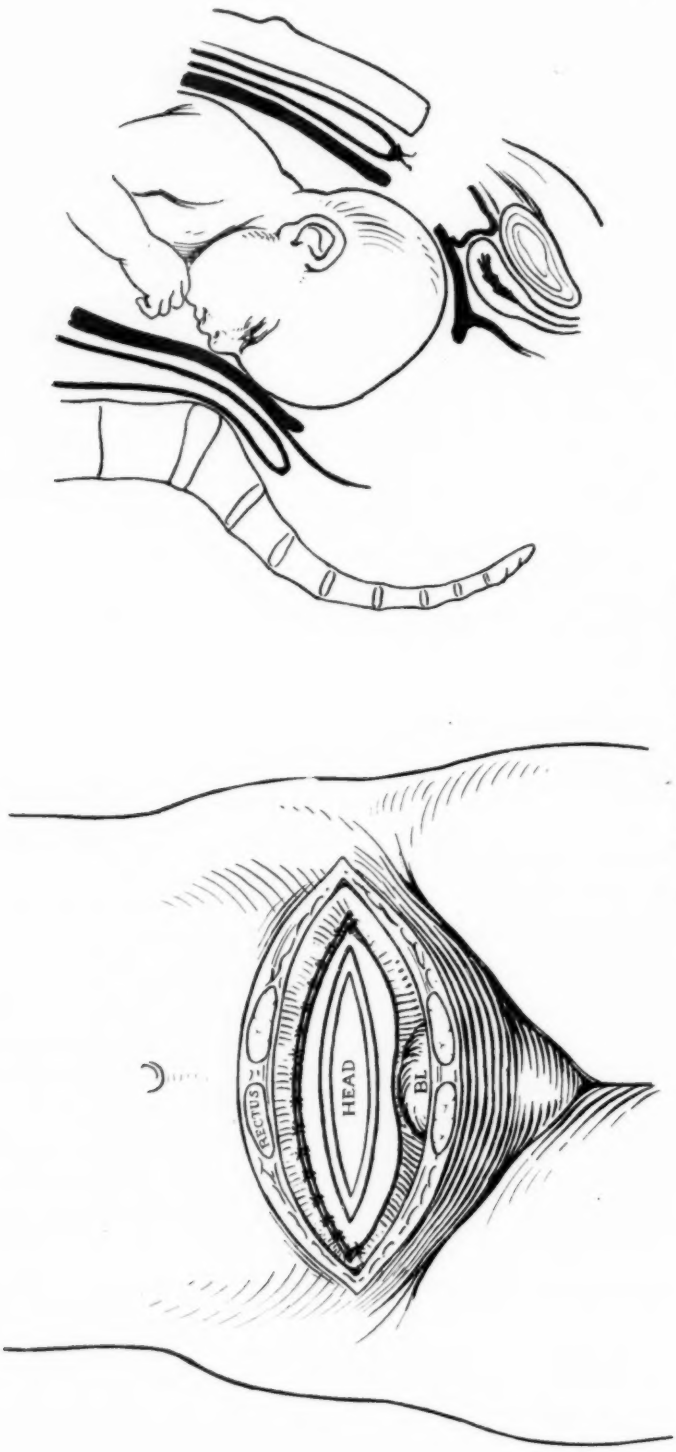

Fig. 5.—Frank's operation, 1906.

Hofmeier used a continuous suture to unite the peritoneal flaps, did not reopen them but drained the wound. The main object of all these methods is to keep the spill out of the general peritoneal cavity; secondarily, to prevent the leakage of lochia into it. (Fig. 6.)

The anatomic studies of Sellheim of the pelvic viscera in the nonpregnant and pregnant states served to clear up many questions regarding all possible methods of approach to the cervix by the abdominal route. Sellheim first tried to follow Physick's recommendation, i.e., to go over the top of the bladder subperitoneally, but he soon found that too often he opened the peritoneal cavity or injured the bladder,—or had to make a little hole in the serosa so that he could look in to see what he was doing. Then he adopted Frank's method

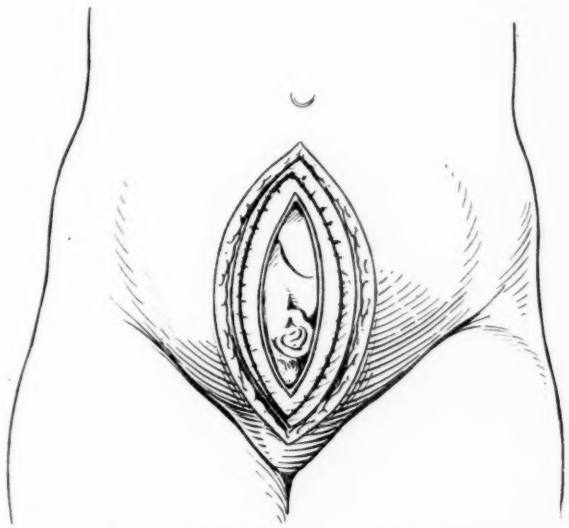

Fig. 6.—Veit-Fromme operation, 1908.

of splitting both the parietal and visceral peritoneum transversely and uniting them before he delivered the child. But Sellheim used the Pfannenstiel incision instead of Bardenheuer's, which was a decided improvement, and he cut the uterus medially instead of transversely. (Fig. 7.) Further experience teaching him that in septic cases all danger of peritonitis was not removed, he sewed both the parietal and the visceral peritoneum to the edges of the skin, then after delivering the child he united the gaping ring of the cervix to the sides of the abdominal incision, leaving the wound open until all danger was past. This he called the "utero-abdominal fistula," and it reminds one of the attempts of Pillore and Lestocquoy of France, 1854 and 1857. (Fig. 8.) Pillore after doing the classic section sewed the uterine edges to the abdominal wound to provide easy escape of the lochia, which measure should avoid contaminating the free peritoneal cavity. Lestocquoy sewed the

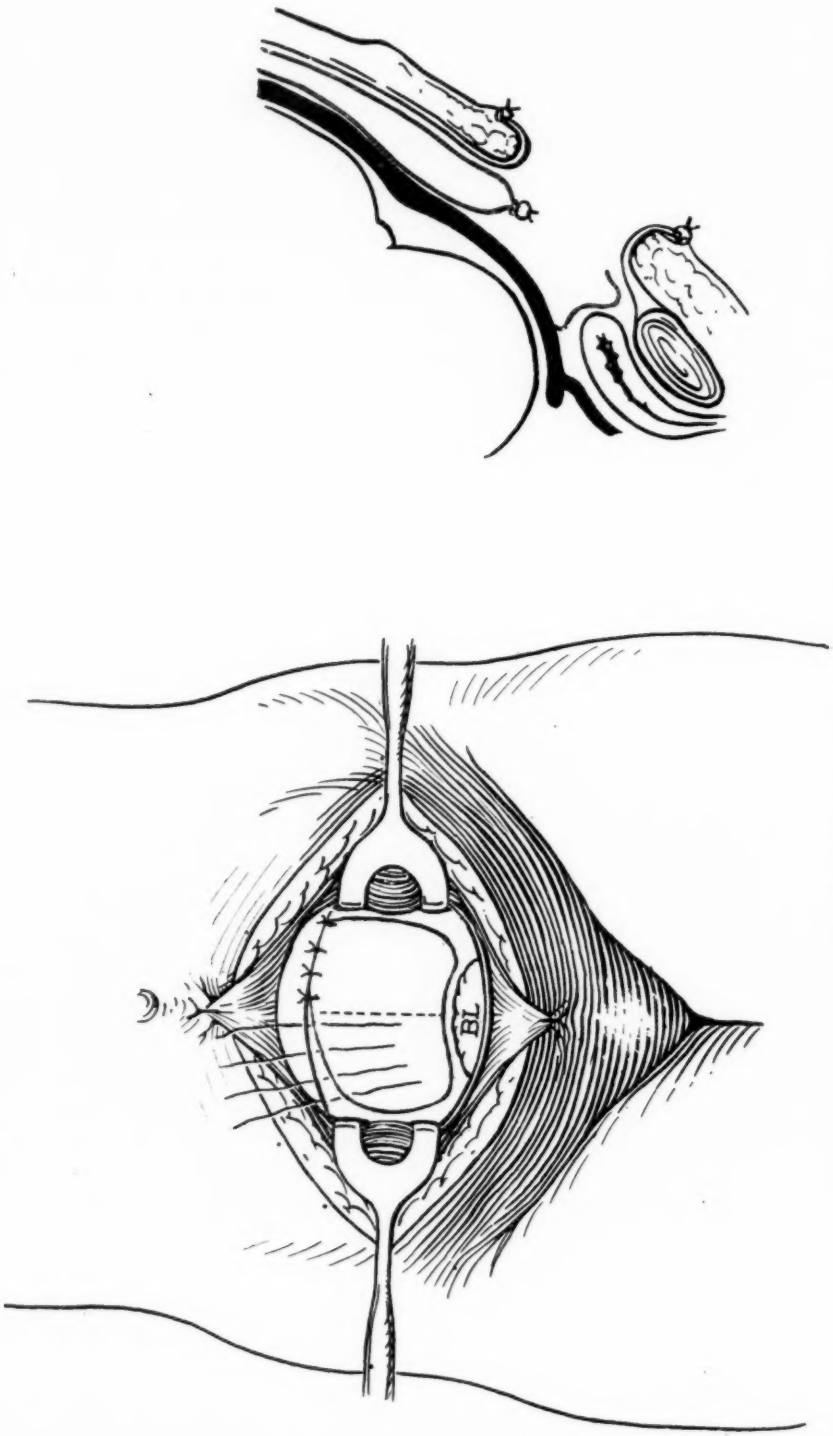

Fig. 7.—Sellheim's third method, 1908.

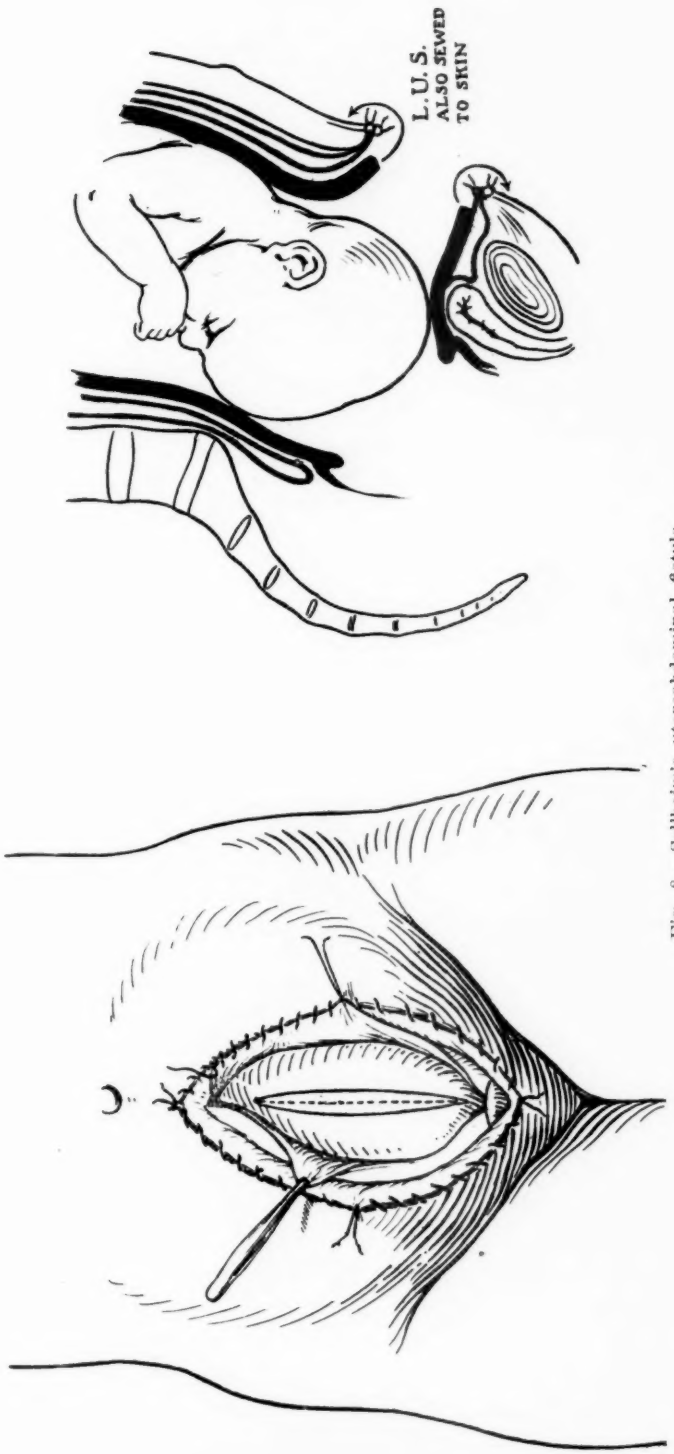

Fig. 8.—Sellheim's uteroabdominal fistula.

uterus to the abdominal wall before delivering the child, hoping thus to obviate both the primary spill and the dangers of lochial discharge. A similar operation was advised by Olshausen, E. Martin, in 1890, and Foster, in 1924, but the abdomen was to be closed. The idea proposed was to make future cesareans extraperitoneal.

Rubeska, in 1908, made a low median incision in the abdominal wall, united the parietal to the uterine peritoneum all the way around and then delivered the child. The whole wound was left open. (Fig. 9.)

In 1910, Sellheim simplified the low cesarean by opening the abdomen longitudinally and omitting the peritoneal suture, packing the free peritoneal cavity off with pads instead, thus making the operation purely intraperitoneal. He made a transverse cut through the vesico-

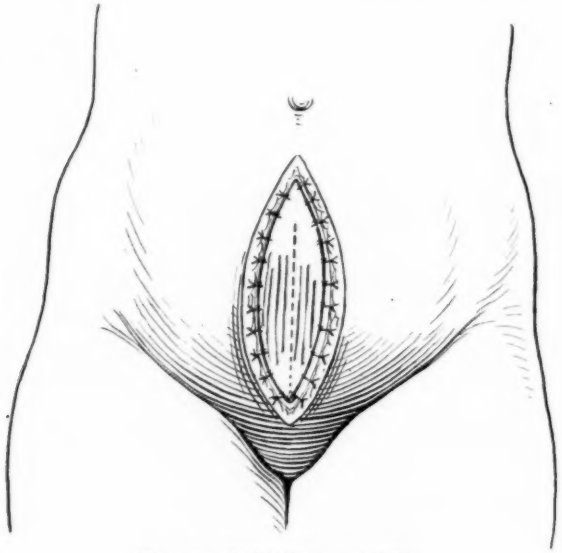

Fig. 9.—Rubeska's operation.

vaginal plica and a longitudinal one in the cervix, thus laying a complete foundation for the low, cervical, intra-, trans- or per-peritoneal cesarean section, or the laparotrachelotomy as it is done today. Franz, Opitz, Henkel, Krönig, Polak, Beck, all performed this operation, making slight inconsequential modifications.

Opitz incises the uterine peritoneum near its bladder attachment, and pushes up a flap to the gray seam. In suspect cases he places a drain under the bladder leading down into vagina. Beck and I incise the loose peritoneum midway between the bladder reflection and the gray seam, making two flaps, an upper and a lower, which are later overlaid in the suturing. Several operators, in the final closure, after uniting the uterine peritoneal edges, secure the union with an additional row of Lembert sutures.

THE EXTRAPERITONEAL OPERATION

Meanwhile other experimenters were trying to perfect the Ritgen-Physick-Thomas-Sellheim true extraperitoneal approach to the cervix. After Sellheim, Küstner, Latzko, Kermauner and Doederlein must be mentioned as having carried on the work. (Fig. 11.)

The inguinal incision was first of all discarded as being technically too difficult, and as being complicated by the dangers of hemorrhage, and of injury to bladder and ureter, besides as not procuring sufficient room for the extraction of the fetus. Küstner makes a rectus incision, Doederlein and Latzko the usual median laparotomy. The peritoneal cavity is not opened, and it is not found difficult to peel the serosa itself gently upward from *off the side of the bladder and the lower uterine segment*, the former being pushed to the right side and held

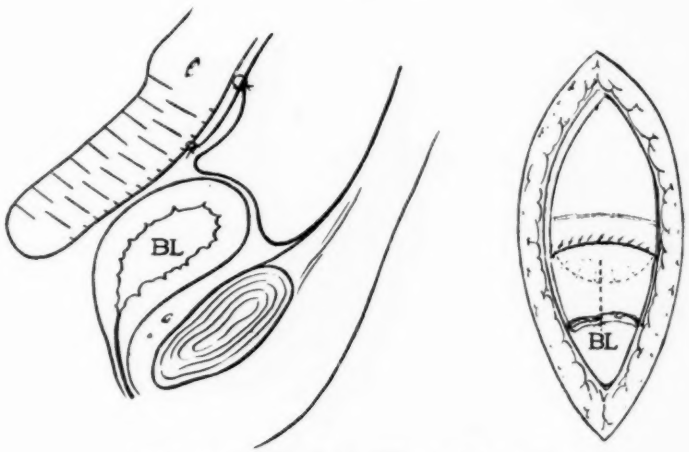

Fig. 10.—Operation of Beck and De Lee.

there with a smooth retractor. A longitudinal median incision is now made in the lower uterine segment for the delivery of the child,—forceps being used.

It will bear repeating that the practicability of this operation depends upon the bladder and the peritoneum being raised up out of the pelvis and the latter being drawn upward over the lower uterine segment *by the prolonged action of the uterus during labor*, and that the ease and safety of the performance of the technic will vary with the degree to which the lower uterine segment has been stripped of its peritoneum, i.e., has become extraperitoneal. This method, therefore, is most useful in cases where uterine action has been strong and operative for many hours.

For the sake of completion, the Solms-Duehrssen operation must be mentioned and, as a matter of interest, the revival by Dr. A. B. Davis, of New York, in 1923, of the old Ritgen-Baudelocque-Thomas gastro-

elytrotomy. Solms combines Duehrssen's vaginal cesarean section with the inguinal incision advocated by Ritgen, delivering the child suprapubically, a very complicated procedure which has not gained any recognition. Davis reports 28 cases of gastroelytrotomy with two deaths, a good showing, but the operation is uninviting and has been superseded by the Latzko method, which is much simpler and founded on better anatomic and surgical principles. It has been learned by bitter experience that the further one advances from the middle line the greater grow the dangers of hemorrhage and the more technically difficult each step of the operation becomes.

All the published modifications of these operations have not been described nor even mentioned here. They are too numerous and in-

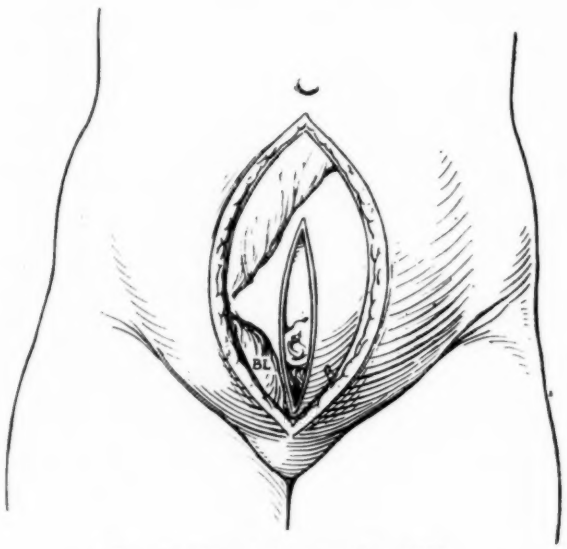

Fig. 11.—Latzko's operation, 1908.

consequential. Those presented signify principles or progressive steps in the technic.

Much confusion regarding the low, cervical operation has been due to the introduction of numerous nondescriptive terms, such as intra-, extra-, trans-, per- peritoneal, etc., and also by the inventors attaching their names to a procedure which is distinguished from another only by the method of abdominal incision or other technicality.

We formerly classified all these varieties under three heads,—first, those in which the peritoneal sac was not opened at all, the attempt being made to lift it off the anterior portion of the inlet, the bladder and the lower uterine segment and, thus, to gain access to the child. These are, and should be called, extraperitoneal or subperitoneal sections.

The next group consisted of those in which the peritoneal cavity was opened but closed again, either by clamps or suture, after the lower uterine segment, i.e., the area of the uterus in which the incision was to be made, had been properly exposed. By closing the peritoneal sac before delivery, the spill was kept out of it. Some operators left the new-formed anterior culdesac and newly isolated peritoneal region to act as a barrier against seepage of the lochia and to render subsequent cesareans truly extraperitoneal. Some removed the sutures and restored the previous anatomic conditions. These operations were intended to be temporarily extraperitoneal, but experience has shown that the suture line often tore during delivery and even if it apparently held and remained water-tight, it was not bacteria-tight. Therefore, these operations were really intraperitoneal and fell into the third class where the technic comprehended the delivery of the child through the lower peritoneal cavity, trusting to packing off the operative area and the healing powers of the serosa to care for both the spill and the delimitation of the infection as well as the seepage of lochia.

In other words, an operation is extraperitoneal or intraperitoneal,—all variants should be put in either of these two classes.

The operation to which the author gave the name laparotrachelotomy is essentially the fourth one devised by Sellheim and consists of the following steps: a median abdominal incision just above the pubis, using the old American "trap door" method; a transverse visceral peritoneal cut one inch from the firm attachment to the uterus; dissection downward of the bladder flap; dissection upward of the uterine flap; a longitudinal incision in the lower uterine segment; delivery; repair of the uterus in two layers; special suture of the fascia; overlapping of the peritoneal flaps in suspect cases only; closure without drainage.

A discussion of the comparative virtues of the different operations was not intended for this paper. Küstner and Doederlein still believe that greater safety against peritonitis and general sepsis is obtained by adherence to the purely extraperitoneal method of Latzko, but the large majority of both German and other accouchers have decided that in that particular regard there is no choice. Since the intraperitoneal methods are simpler of performance and equally safe, these are given the preference.

Whereas, at first, after Frank and Sellheim published their results, the new operations were hailed with joy as a good way out in infected cases and a means of lifting the opprobrium of craniotomy on the living child, more recent experience is demonstrating that Küstner is going too far in recommending the suprapubic delivery even in infected cases. Bumm, one of the most vociferous proponents of this

view, reversed his position just before he died. This means, not that the low operations have failed, but that we must not expect too much of them. I believe they should replace the classic section in all cases where it has heretofore been indicated and that they permit us to extend the indication for abdominal delivery to cases where, up to now, the classic method is too dangerous.

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426 East Fifty-first Street.

(*For discussion see page* 582.)

FURTHER STUDIES IN PUERPERAL INFECTIONS AND THEIR TREATMENT*

By John Osborn Polak, M.Sc., M.D., Brooklyn, N. Y.

ON two previous occasions I have presented before this Society, preliminary communications on this subject and have profited from the friendly discussion and criticism which these papers have provoked.

While in the last twenty years hospital obstetrics has shown a definite improvement in both maternal morbidity and mortality, it is a fact that even under the most favorable conditions, puerperae become infected and puerperae continue to die, notwithstanding all that can be done for them. It is, therefore, but natural that we should be willing to try out some of the many suggestions advanced for the destruction of bacteria in the blood stream and for the inhibition of their growth.

Recently, three drugs (dyes of the analine group), i.e., acriflavine, gentian-violet, and mercurochrome –220, have received considerable attention and more or less enthusiastic support.

To those of us who see a large number of infected puerperae, the credibility of the reported results are of great moment, and it is in an attempt to establish the place that these drugs should have in our armamentarium, that we are presenting the following argument supported by our laboratory and clinical observations.

In the final analysis, we all must admit that the woman who recovers from a blood stream infection, does so by producing her own immunity against it. For no matter what is done, until the blood and body fluids have finished their battle with the toxins, no improvement can be expected. Puerperal infections are in no way different from infections of other tissues, save that the lymphatics and blood vessels in the puerpera are more receptive than in the normal nonpregnant woman.

Bacteria which reach the blood stream must be destroyed by a marked increase in the polymorphonuclear cells or they will multiply and produce toxins, destroy the white cells, the red cells and impair the tissues through which they pass, leaving an aftermath of more or less destruction.

Clinically this is shown by the sudden drop in the polynuclear percentage, progressive anemia, the failing cardiac action, the presence of increasing colonies of bacteria in the blood and in the tissues and the defective liver and kidney function.

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To combat the onslaught of these bacteria, nature calls to her aid the polymorphonuclear cells which by their increase in numbers attempt to break the bacterial attack. Therefore, in every infection there is a struggle for existence between the bacterium and the leucocyte. In the first stage of every infection there is a marked increase in the polynuclear cells,—these are usually proportioned to the severity of the disease. A sudden drop in the number of the polynuclear cells indicates a loss in the reactive power of the patient.

Clinically, we know that the normal resistance of the woman may be reduced by excessive blood loss, by the presence of an existing toxemia, and by excessive tissue trauma.

The normal woman resists ordinary bacterial infection, because she has a reserve to combat it, a reaction takes place in the blood stream and in the tissues and the dead bacteria with their toxins are eliminated by her emunctories. However, the woman with reduced resistance cannot do this; neither can the woman infected by a hemolytic organism which rapidly destroys the red and white blood cells; and which also has its effect on the parenchyma of every eliminating organ, as well as the heart muscle, for against them she is unable to produce her natural resistance.

As these are admitted facts, it would seem reasonable to suppose that in order to combat blood stream infection, one of two conditions must obtain: Either we must increase the resistance of the individual by supplying her with such cellular elements as can react and destroy the bacterial invaders by the natural processes, or we must put into the circulation some chemical which will destroy bacteria without impairing the function of the individual tissues.

It has been claimed that gentian-violet, acriflavine, and mercurochrome can do this. To test the efficiency of any chemical which may be introduced into the blood, we must first determine certain facts: (a) The effect of the drug on the red and white cells, (b) On the fragility of the red cells, (c) Their effect on the coagulation and bleeding time of the blood, and (d) The effect on the viability and phagocytic power of the leucocyte.

Second: Does the intravenous injection of acriflavine, gentian-violet, or mercurochrome in concentration compatible with life give to the whole blood any bactericidal or bacterial inhibiting property which is not present in the normal blood?

Third: What effect have these drugs when given intravenously on the several body tissues, including the kidneys, liver, lungs, nervous system, and heart muscles?

Fourth: Does intravenous injection to these dyes reach such a concentration in certain tissues as to have a bactericidal or bacterial inhibiting effect on the organisms in those tissues?

Fifth: What is the cause of death in the animals that die following a large dose of the drug?

Finally: Can the injection of a nonlethal dose of the dye prevent death after the injection of a lethal dose of the organisms?

Experiments have shown that the tissues remove the dyes from the blood stream and that they become impregnated with them.

The excellent series of experiments with acriflavine conducted by Meleny and Zan, seem to prove that the white cell count is increased within three hours of the injection, and this rise corresponds in degree to the amount of the drug used. The leucocytosis falls again in from three to five hours and reaches the normal within twenty-four. The "polys" rise and fall accordingly, but the leucocytosis does not persist, neither is there any appreciable effect on the red cells. This fact has been confirmed by animal experimentation in our own laboratories by Eggerth and checked clinically on the patient in our wards.

Animal experiments as to the effect of these dyes on the fragility of the red cells show that the difference between the normal blood and the blood one hour after the injection of doses ranging from 2.5 to 37.5 mg. per kilogram of body weight, is hardly perceptible. However, when the test is carried out in vitro with known concentrations of the dyes, more information is gained, for it is found that a concentration of 1:1000 causes marked increase in the fragility, while with the higher dilutions up to 1:40,000, the effect is only a slight increase and when used in 1:40,000, there is no effect at all.

Likewise, it has been shown that in dilutions of 1:5000 to 1:120,000, there is no definite delay in clotting time but if the concentration is in 1:1000, there is a complete inhibition. Also, that there is no effect on the bleeding time even when larger doses are employed.

Dilutions from 1:1000 to 1:100,000 were employed to test the effect of these drugs on the viability of the leucocyte. In a strength of 1:1000 the cells were rendered motionless and stained yellow. In 1:10,000 both the motility and staining qualities were inhibited, but in dilutions of 1:100,000 there was no noticeable effect.

Similar experiments were conducted by Brill and Myers with mercurochrome and gentian-violet to determine the bactericidal efficiency of these drugs by the intravenous route.

These investigators, not only made a study of the clinical results obtained in the use of intravenous injections of mercurochrome and gentian-violet, in bacteriemias due to the staphylococcus, the streptococcus, and the colon bacillus, but carried out an experimental study of the effects of exposure of these bacteria to mercurochrome and gentian-violet in dilutions of 1:10,000 which represents the highest concentration obtainable in the human body, being the largest dose of the dyes consistent with life.

Both of these groups of investigators have used virulent strains of hemolytic streptococci to determine whether or not any of these dyes had an inhibitive effect on the bacterial growth, or were destructive to the bacteria already in the blood stream.

From these experiments and those conducted in our own laboratories by Eggerth we may draw the following conclusions:

First, that the bacterial inhibiting power of neutral acriflavine upon the hemolytic streptococcus within the body is so slight, even in large doses, that the intravenous injection of the dye is not a legitimate therapeutic measure in hemolytic bacteriemia.

Second, Eggerth has proved that acriflavine has a selective action on certain body tissues which causes it to be taken up by some of these tissues in such concentration as to injure or destroy them. This is especially true of the kidney which shows degeneration of the convoluted tubules while the conducting tubes contain casts and detritus. The liver shows degeneration about the central vein and the liver cells are shrunken and contain large quantities of fat. The blood urea and nitrogen steadily rise from 30 mg. in 100 c.c. in the fatal cases to 70 mg. in the nonfatal. The urine always shows albumin and casts.

With these facts proved, it is unlikely that acriflavine or mercurochrome could cause other than a transitory leucocytosis in these prostrated women who cannot of themselves produce a leucocytosis in response to the infection. Of course any intravenous injection will temporarily raise the leucocytosis. But it is hardly conceivable that an organism with organs which have already sustained serious parenchymatous changes can functionate properly in the presence of added chemical irritation.

Regarding mercurochrome, it may be said with positiveness, that intravenous injections in no way interfere with the progress of the infection. This has been our experience clinically, and has been confirmed by experimental evidence showing that hemolytic organisms exposed for three hours to concentrations of 1:10,000, which represents the maximum concentration of this dye obtainable in the circulation has no bactericidal action, and that when employed in the strength of 7.5 mg. to the kilogram of body weight, diarrhea and urinary suppression with prostration have resulted.

On the other hand, properly matched human blood supplies the necessary resistance against bacterial multiplication. Its advantage is that it is nontoxic and when combined with Ringer's solution to which acid sodium phosphate is added, restores the alkalinity and dilutes the toxins already present; besides adding the necessary cellular elements to combat the bacterial invasion.

Transfusion with fresh human blood by the Unger or Miller method

raises the blood pressure, restores the alkalinity, stimulates the heart action and at least temporarily improves the well-being of the patient.

In our experience, many patients die from infection who never show a positive blood culture or a peritonitis. Hence, it must be accepted clinically that these patients succumb to a toxinemia which has impaired the cardiac function by intoxication and diminished the eliminative functions of the liver and kidney by degenerative changes. Therefore, it does not seem reasonable to employ these dyes when it has been shown that they have an affinity for the tissues of the liver, the kidney, and the heart.

Our study of infections show that there is an immediate reaction on the part of the tissues to bacterial invasion; that if this reaction is sufficient there is prompt evidence of improvement; while there is a marked increase in the leucocyte and polymorphonuclear cells. This reaction may be maintained if the tissue resistance and the individual resistance is greater than the virulence of the germ—but if the bacterium is of the hemolytic strain, this reaction promptly subsides and the seriousness of the picture becomes more pronounced. We have come to feel that as soon as this overpowering evidence is apparent, which is shown by the rising temperature, rising pulse, and lowered polymorphonuclear resistance, that the introduction of human blood in quantities of from 200 to 300 c.c., typed and matched, to which Ringer's solution has been added, will immediately change the picture and produce an increased leucocytosis and a reduction in the pulse rate, with an improvement in the general condition.

It is our firm belief, that the patients supposed to have recovered as a result of the employment of injections of these chemical solutions, would have done so from the intravenous injection of any foreign or protein substance; for it is well known that such intravenous medication will always raise the leucocytic resistance temporarily, but fails to maintain it.

We have on many occasions seen patients with a positive blood culture have mercurochrome introduced and seen this injection followed by a marked reaction; namely, a chill, a temperature of 105° or 106° F., a pulse of 160 or 170, dyspnea, cyanosis, apprehension and fear; and when the blood was taken six or twelve hours later no bacteria were present, but when a culture was again taken twenty-four hours later, an increased number of colonies were found. In the interim, between the reaction and the subsidence, the patient has apparently become more seriously sick because of the diarrhea, the intestinal pain, the urinary suppression and the presence of albumin and casts, all of which add to the picture of a chemical poison.

Notwithstanding the statements to the contrary, in our experience, repetition of the drug has always increased these symptoms. On the other hand, when blood transfusion has been given, while the colonies

have not immediately disappeared, they have always been reduced in number and as this was repeated, they have become fewer and fewer; while body functions have been improved without tissue irritation.

When Ringer's solution with acid sodium phosphate added in a proportion of 1:1000 grams to the transfusion is employed, the alkalinity of the blood is increased and maintained for sufficient time to allow the natural body fluids to carry on their battle with the toxin; for only by increasing the activity of the cellular elements of the blood and of the body fluids can bacterial invasion or bacterial growth be stayed.

Many have objected to transfusion because of the severe reaction that occasionally occurs. This can be obviated by doing the transfusion during the remission in temperature; preceding it with a hypodermic injection of ¼ gr. of morphine and a $\frac{1}{200}$ gr. of scopolamine; and matching and rematching the blood of both donor and recipient. These three simple precautions will obviate putting the added strain of reaction upon an already weakened patient.

Transfusion has another very important therapeutic use. In those severe infections which are prolonged over weeks with consequent secondary anemia and leucopenia where the individual resistance by prolonged illness has been so lowered that reaction is ineffective, transfusion with a supportive diet and fresh air, offers the only chance of cure. One mistake that we are apt to make, is to delay the activity of our combative treatment until the bacteria have multiplied to such an extent as to produce an overwhelming toxemia. It is much easier to produce a reactive resistance with the patient when she becomes infected, by early transfusion, than it is to wait for the return of the blood culture.

Briefly, therefore, we can say that the introduction of human blood always increases individual resistance, whether there is a positive culture or not. It, therefore, aids the eliminative function by increasing the alkalinity of the rest of the blood and maintaining good heart action.

On the other hand, there is no one present who would advocate the introduction of any of the dyes into the circulation unless there was present a definite bacteriemia; for the effect of these chemicals on the liver, the kidney, the nervous system, the heart, and intestinal tract are such as to reduce rather than increase normal body resistance.

From this study, we are safe in drawing the following conclusions:

1. That the puerpera who recovers from a puerperal infection, whether it be in the blood stream or in the local tissues, does so as a result of a reaction sufficient to inhibit the further growth of the bacterial invader.

2. That it has been shown experimentally and clinically, that these dyes in a concentration of 1:10,000 which is the highest concentration compatible with life, irritates the liver, kidney, and heart, and

results in a definite pathology in each of these organs; that the intravenous use of these dyes will give only a temporary increase in the leucocytosis; and that this increase is not maintained for a longer period than twenty-four hours.

On the other hand, blood transfusion does increase the cellular elements of the blood, does increase its alkalinity and the alkalinity of the tissue fluids and thus increases the reaction against bacteria; as well as improving the function of the several eliminative organs.

20 LIVINGSTON STREET. (*For discussion see page* 583.)

THE INFLUENCE OF THE MALE SEX GLAND ON THE FEMALE. AN EXPERIMENTAL STUDY TO DETERMINE THE SEX RATIO OF THE OFFSPRING*

BY FRANCIS KOVACS, M.D., BALTIMORE, MD.

(From the Obstetrical Department of the Johns Hopkins Hospital and University, carried out with the support of the Rockefeller Foundation)

INTRODUCTION

THE problem of the origin of sex is as yet unsolved. It does not fall within the scope of this paper to review the extensive literature which has accumulated on this subject; rather I will content myself with mentioning some of the more important theories advocated and will point out the contradictory nature of some of the views set forth.

Numerous statistical studies bearing on this problem have appeared from time to time. Hofacker, Sadler, Korber, Schimann, Kollmann, Grünsparon and latest (1924) Fetscher[8] thought to find the cause of the origin of sex in the age of the parents; according to Hertwig,[12] Pearl and Parshley[28] it is due to the age of the germ cells, to the state of their respective maturity (yet this theory has been later denied by Pearl himself). According to other authors, the nourishment of the parents plays an important part in the determination of the sex. Well nourished parents are inclined to produce more females, while those poorly nourished tend to produce males. On mammals, Cuenot first carried out experiments of this kind; but following him Schultze[32] by his experiments on white mice, refuted one after another of these theories, which based the determination of sex on different environmental influences and on the vigor of the parents. They have since been almost abandoned.

As modern biologic methods became more and more extended, many believed that sex is fixed already in the morphologic structure of the

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germ cells and that it is definitely decided at the moment of the fertilization of the ovum (Lenhossék,[19] etc.). This theory was supported by the fact that we are able, for instance, to determine the sex character of the germ gland in man from its morphologic appearance at the beginning of the second embryonal month.

Careful histologic researches have shown that there are animals in which the male, or female respectively, produces two kinds of germ cells, which differ in the quantity and possibly quality of their chromatin substance. Thus the sex of the offspring would depend upon the chromatin structure of the germ cells. There are several publications affirming that there is likewise to be found such a chromosoma dimorphisma in man, corresponding with the different sexes of the spermatozoa (Guyer,[10] Painter[27]). According to this theory the chromosomes of the germ cells follow the touch of an invisible hand at the maturation division, which determines the sex of the succeeding offspring. We do not know even approximately this factor which controls the sex of the chromosomes. At any rate, it is possible that the differential chromosomes are only the earliest criteria of the sex character which we are able to observe rather than the real cause (Moltz). From this viewpoint, we could likewise inquire about the possibility of influencing the distribution of the germ chromosome at the maturation division by external influences in such a way that we could direct the sex character of the descendants. The uncertainty of the sex character of the germ cells has been proved by the observations and experiments of several authors, who have been able to influence the sex ratio, especially in cases of lower organisms, by using different thermal, chemical, physical, photodynamical, and other irritants (Baltzer, Hertwig, King, Smith, etc., and lastly Blum, with white mice). Experiments, however, in increasing numbers tend to prove that the sex character is not an inherited quality in the sense of Mendel's law, i.e., it is not a factor bound closely to the chromosomes, but rather external influences decide whether the fertilized egg will develop into a male or female individual. We found several authors who deny the theory concerning the decisive part of the dimorph-chromosomes in the developing of the sex. For instance Wilson asserts that the heterochromosomes have only an indirect effect upon the sex by influencing the germ cell metabolism (the ova fertilized by spermatozoa containing more chromosomes, get more animated metabolism and thus they become female individuals, and *vice versa*). Others hold the opinion that both sexes are so-called "heterozygota," i.e., the factors of both sexes are present in both kinds of sex germs in latent condition (Castle). The unknown agents located in the chromosomes only decide in which line (male or female) the further development of the fertilized egg must progress.

As we know, in the first place from Steinach's experiments, the

development and maintenance of the secondary sexual features are produced in the vertebrata by the activity of the internal secretion of the sex glands. Along this line are the very interesting observations of Keller and Tandler that, if a cow gives birth to twin calves of opposite sexes, in ninety-four cases out of a hundred, it occurs that the female has undeveloped ovaries or other sex organs, and in addition, she is provided with organs of the male sex, like penis or vesiculus seminalis, etc. These authors have examined the embryonal circulation of such twins and have found that in all such cases where these abnormalities of the female were present, the two placentas of the twins communicated with each other by large vessels. In cases where this communication was not present, the development of the female was normal. On the basis of these findings, the authors have reached the conclusion that the hormones produced by sex glands of the twin brother, not only assist the developing of his own sex, but at the same time hinder the development of the sex character of the twin sister, likewise bringing about the development of some of the male sex organs. These observations and Steinach's well-known transplantation experiments resulting in the successful masculinization of very young, undeveloped females, and the feminization of males respectively, makes very plausible the supposition of Steinach and Tandler, according to which the fertilized egg in the earliest stage of its development has not yet a sex character. Only when the sex glands appear does the embryo begin to develop under the influence of these glands, along the line of the male or female sex. According to Sellheim,[34] single ovum twins have always the same sex, because even in cases in which the twins have a developing basis of different sexes, the sex gland of one of the twins overwhelms that of the other one through their communicating blood circulation. Thus, if the germ gland of the male predominates, it changes the sex character of the other embryo into the male line, and *vice versa*. On the basis of the studies made on the Freemartin twin calves, Lillie and Basconi[21] supposed that the effective action of the male hormone begins in a very early stage of the development of the male embryo. Interstitial cells appear in the testis of the calf as soon as the embryo is 27.3 cm. long. On the other hand, the corresponding cells in the ovaries of the female do not appear until the time of the delivery.

I. EXPERIMENTS WITH INJECTIONS OF TESTIS TISSUE

On the basis of the above observations and experimental facts, we felt justified in attempting to find out whether or not we could influence the sex ratio of the descendants by introducing fresh testis tissue (and thus its hormones) continuously parenterally into the female, before, during and after her mating. In that way we expected to

effect one-sided germinal impregnations. Steinach has effected artificially an influence of the sex character by his transplantation experiments in extrauterine life. Keller and Tandler observed the same by natural factors in early intrauterine life of the single ovum twins, due to the testis hormones of the twin brother. We expected by these projected experiments only to interpose the influence of the sex of the individual in its earliest stage of development in the first differentiation of the egg, perhaps even into the stage of the maturation division of the ovum (before its fertilization). Upon going over the literature, we have been unable to find any publication dealing with this idea.

In the experimental study which we have undertaken in the hope of bringing some new light into the problem just propounded, we have chosen the albino rat for our breeding experiments, for several reasons. In the first place, it needs only limited space, little attention and is relatively cheap. Moreover, its morphology and biology have been worked out in every detail in great part by the efforts of American writers (Long and Evans, Bishop, Huber, etc.). Furthermore, it is suited to our purpose for the additional reasons that it has great fecundity, an estrus cycle of about five days, and that the female begins to breed when she is seventy to a hundred days old; while the duration of pregnancy is twenty-two days and that of lactation twenty-one days. Moreover, the animal breeds at any season of the year and coitus is followed by pregnancy in 80 per cent of the cases. In our experiments, we have chosen a number of adult female and male rats, varying from five to fifteen months of age, which were well developed and nourished, the females already having given birth to litters during our observation before the treatment, and the males having shown distinct signs of sexual activity.

In the first series of our experiments, we treated six female rats by injections of freshly prepared testis tissue obtained from young adult rats. At the same time we mated the animals and we kept them together continuously with the males. The injections were made subcutaneously into the lower abdominal wall. We made six injections during the entire period of the treatment (fourteen days) at intervals of two days. The individual dose was 1 c.c. or a total of 6 c.c. As we are completely ignorant concerning the cellular or chemical component, or components of the testis, which are concerned in bringing about the supposed hormonal reaction, we made no attempt to prepare our extract by complicated physical or chemical procedures in the hope that by avoiding such extensive procedures, the important unknown components would escape destruction or removal. For this reason, we prepared the testis extract as follows: Both testes of a young male obtained by castration were, after removing the tunica

albuginea, cut up (together with the filled vesicula seminalia) on a sterilized board into as small pieces as possible by means of a sterile razor. The material obtained was then ground in a sterile mortar with 15 c.c. of physiologic salt solution and eventually a homogenous pulp was obtained which we injected directly with a Record syringe. A few drops of chloroform kept it permanently sterile. I should, however, emphasize that in no case we used extracts kept for more than three or four days. In this way we believe that we have not only retained all of the effective components of the testis, but have excluded the possible production of autolytic and oxidation products. This is particularly important, as the latter process is able to change the character of lipoids to such an extent that those formerly insoluble in water may become soluble and at the same time lose their solubility in ether, chloroform, benzol and similar solvents.

All the six females treated in this way became pregnant. Four of the animals gave birth to litters twenty-two days, and two of them twenty-five days after the mating. That means, all of the females have been fertilized within four days after being put with the males, as it occurs normally in the rat. The total number of the offspring was forty-eight, which corresponds to 8.1 offspring for each animal. As the albino rat has normally an average of seven to eight young in a litter, we see that the number of offspring was not influenced by our treatment. Among the offspring, we found twenty-eight males and twenty-one females, a ratio of 133 to 100.

The normal sex ratio of the albino rat as determined by Dean Helen Ring, of the laboratory of the Wistar Institute in Philadelphia, on the basis of data collected on 31,670 newborn rats, is 105.50 to 100.0. Comparing this statement with our figures, we find a change in the sex ratio of 27.5 per cent, to the advantage of the male in our experiment. Whether this not insignificant difference is due only to chance, or to the testis hormones carried into the females during the first part of their pregnancy, can only be decided by experiments carried out on a very great number of animals.

Moreover, led by the idea that the testis hormones carried into the females might perhaps influence the ova during their maturation division and thus change the distribution of the chromatin to the advantage of the male sex, in a second series of five rats the animals were mated only on the ninth day after beginning of the injections, so that they had received four injections prior to the possibility of their becoming pregnant. After this first mating, the male and female rats were kept together permanently. Our method was exactly the same as in the first series except that the treatment lasted a little longer (ten injections). The result of this experiment is shown in Table I, page 532.

TABLE I

	BEGINNING OF TREATMENT	NO. OF INJECTIONS GIVEN BEFORE MATING	DAY OF MATING	END OF TREATMENT	INJECTIONS		DAY OF DELIVERY	DAYS BETWEEN MATING AND DELIVERY	DAYS BETWEEN END OF TREATMENT AND DELIVERY	NO. OF OFFSPRING		
					Total No.	Total Quantity				Male	Female	Total
I	Jan. 9	4	Jan. 17	Feb. 7	10	10 c.c.	Mar. 19	61	40	3	2	5
II	"	"	"	"	"	"	Apr. 10	82	61	4	2	6
III	"	"	"	"	"	"	Apr. 20	92	71	2	2	4
IV	"	"	"	"	"	"	Apr. 26	98	77	4	2	6
V	"	"	"	"	"	"	May 15	118	97	3	3	6
									Total	16	11	27

Table I clearly indicates in the first place that the beginning of the treatment, eight days before mating, resulted in a definite temporary sterility. (We know from many different serologic tests that the antibodies resulting in immunity, generally appear in the blood in six to eight days.) This sterility could not have been effected by chance because the males and females were kept permanently together. That neither repeated trauma, nor other untoward circumstance connected with the injections, had anything to do with the production of sterility, is strikingly proved by the first series of rats which were treated by exactly the same technic. (No complications, subcutaneous abscess, etc., followed the injections, neither were any differences noted in the behavior and habits of the treated animals.) All of these became pregnant without exception after being put with the males. Moreover, conception occurred in the first rat nineteen, in the second forty, in the third fifty, in the fourth fifty-six, and in the fifth seventy-six days after completing the treatment, and during this time the traumatic or other disturbing influence of the treatment could not be felt. On the other hand, the fact that the rats later became pregnant under the same circumstances, indicates doubtless that no obstacle existed on the part of the physical condition of the animals in regard to their delayed fertility. If we compare the average time within which conception occurred in the first series of six rats (treated simultaneously with mating) and the second series of five rats (treatment beginning eight days before mating), we find in the first group 17 days against the 69.2 days of the second group.

The result of this experiment enables us to state that we are able to produce a temporary sterility in females in injections of freshly prepared testis tissue. This immunity against pregnancy lasts three to eleven weeks after finishing the treatment.

This finding confirms the reports of several other authors. Spermatoxins were produced first simultaneously by Metschnikoff and Landsteiner, later by Dunbar. De Leslie rendered female mice sterile for six to twenty days by the injection of spermatoxic serum. Kohlbrugge reports that in the normal copulation of rats and other rodents, the spermatozoa penetrate the epithelium of the generative mucosa and invade the underlying connective tissue. If this takes place in women the commonly found sterility of professional prostitutes may be due in part to spermatoxins.[7] Wallstein and Ekler[35] report that in rabbits a distinct Abderhalden reaction for testicular protein may be obtained shortly after coitus. Metalnikov and Stelnikov[25] have found that when spermatozoa are placed in the body tissues, a spermatoxin is produced. Dittler[5] reports that by immunizing female rabbits with progressive doses of rabbit ejaculation fluid (injected into the ear vein), they were made sterile for a period of several months. He also

found that the immunization did not hinder ovulation, nor in any way affect the habits of the rabbits. In some cases in which he made injections of human ejaculation fluid, the animals have not been rendered sterile. Venema[36] carried out experiments similar to these on two rabbits with testis emulsion, but with very questionable success. Guyer[10] in a recent article also concludes from his experiments that rabbits or guinea pigs, treated parenterally with ejaculation fluid of their own species, became temporarily sterile and this condition is indicated also in the spermatoxic effect of the blood serum. The same is affirmed by Hektoen.[11] Lastly Cartney,[3] from the Hull Laboratory in Chicago, reported the results of his experiments on albino rats, according to which he was able to render his animals sterile for a period of two to twenty-two weeks by subcutaneous injections of ejaculation fluid and testis extract of the same race. Extracts of other organs did not have this effect. He found also that this sterility was due to the spermatoxins which he has shown to be present in the vaginal and uterine secretion of the immunized rats.

More interesting are the findings shown in Table I, concerning the sex ratio of the offspring. The total number is twenty-seven, of which sixteen are males and eleven females. Converting these numbers, we obtain the ratio 145.40 males to 100 females and so the changing of the sex ratio from the normal basis to the advantage of the male is 39.9 per cent. If we combine both series in order to get a larger material, we find that the total number of the offspring of the eleven female rats treated with testis extract is seventy-six, out of which number forty-four are males and thirty-two females. This corresponds to a ratio of 137.5 males to 100 females. The average number of the litters in Table I is only 5.4, distinctly lower than the normal one.

Though we are aware of the fact that the relatively small number of our experimental animals prohibited us from drawing far-reaching conclusions, yet we feel inclined to believe that this resultant change in the sex ratio of the offspring to the advantage of the males might be due to some minute changes occurring in the chromatin structure of some of the eggs, or in the earliest stage of the embryonal development caused by the hormones of the testis tissue.

II. EXPERIMENTS WITH TESTIS TRANSPLANTATIONS

The parenteral administration of testis extract to the female has several disadvantages. The preparing of the removed testis for the purpose of injection, and also the preserving of the extract even for hours or days, effects unavoidably autolytic and auto-oxidation processes which cannot be without significance in relation to its effective components. Besides that, we must not forget the process of parenteral digestion which occurs during the resorption of the injected

material. Thus the hormones of the testis tissue brought into the organisms become changed during the course of its resorption.

In order to avoid all these alterations, we transplanted the testes of young adult male rats into ten young females which had already given birth to litters during our observation previous to operation. In that way, we expected to be able to observe the effect of the unchanged male hormones on the sex ratio of the offspring.

We made the transplantations in every case intraperitoneally. Both the male and female were etherized at the same time. First we opened the abdominal cavity of the female, took out one testis of the male, cut it on its convexity into two parts and laid the free gland surface on the parietal peritoneum of the right abdominal wall, sutured its tunica albuginea to the parietal peritoneum with fine catgut. Finally, we covered the transplant with omentum. We transplanted the second testis of the male in an identical manner on the other side of the abdominal wall; then we closed the abdominal cavity. Finally we closed the wound of the male. We followed out one of the principal rules of transplantation, to work with speed. We took care also, not to squeeze the testis tissue. In the following table there are shown only the rats whose wounds healed without any complication. The females were kept together permanently with males from the fourth day after the operation. The rats becoming pregnant were isolated later.

Table II shows the results obtained in this series of animals.

Table II indicates that in six cases out of the ten (Cases V, VI, VII, VIII, IX, X) the transplantation was successful according to the results of the histologic examination performed seventy-four and eighty-one days after the operation. In most of the successful cases the transplant was to be recognized macroscopically; in others only the histologic examination proved the presence of more or less functioning glandular testis tissue, surrounded by granulation tissue amid the muscles of the abdominal wall and the covering omentum (Figs. 1, 2, 3, 4). That the transplanted tissue is living and functioning is indicated in the sections by the sharp picture of the tissue structure and by the distinct and well-colored nuclei of the cells. The protoplasm of many gland cells is filled with secretions (Fig. 4). The germinal cell elements of the tubuli semiferi are atrophic, degenerated, the spermatozoa have disappeared (Figs. 5, 6), and so the specific function of the germ cells, spermatogenesis does not occur any more. On the other hand, the interstitial cells have proliferated (Fig. 6).

I wish to point out the surprising fact that the ovaries, even in the cases of doubtlessly successful transplantations, did not show signs of any significant change. Their size was normal (except in the Case II, Table II, in which we found a marked atrophy and anemia of the

TABLE II

	DAY OF OPERATION	DAY OF MATING	DAY OF DELIVERY	OFFSPRING			DAY OF AUTOPSY	FINDING OF AUTOPSY			
								Transplantation		*Genitalia*	
				Male	Female	Total		Macroscop.	Microscop.	Macroscop.	Microscop.
I	Jan. 31	Feb. 4	Mar. 5	7	3	10	Apr. 15	Only adhesions. No testis	No testis tissue	Normal	Normal. Many fresh corp. lut.
II	Jan. 31	Feb. 4					Apr. 15	L. incapsulated necrotic testis; R. only adhesions	L. necrotic tissue, leucocytic infiltr. R. no testis tissue	Atrophic, anemic genitalia; ovaries half of the normal	Some follicles in ovaries, much hyaline tissue. Few corp. lut.
III	Jan. 31	Feb. 4	Mar. 17	2	1	3	Apr. 15	Only adhes. on both sides. No testis	No testis tissue	Normal	Normal; many fresh corp. lut.
IV	Feb. 1	Feb. 5					Apr. 15	Scartich tissue, adhes. No testis	No testis tissue	Normal	Normal; many fresh corp. lut.
V*	Feb. 1	Feb. 5					Apr. 22	R. flat testis rest like lentil. L. adhes. only	R. few testis tissue. L. no testis tissue	Normal	Normal; many fresh corp. lut.
VI*	Feb. 1	Feb. 5	Mar. 19	4	1	5	Apr. 22	L. granulation tissue like lentil. R. no testis	L. glandular testis tissue. R. no test. tissue	Normal	Normal; many fresh corp. lut.
VII*	Feb. 2	Feb. 6					Apr. 22	R. flat testis rest like lentil. L. adhes. only	R. glandular testis tissue. L. scartich only	Normal	Normal; many fresh corp. lut.
VIII*	Feb. 2	Feb. 6					Apr. 22	L. adhes. only R. test. rest like lentil	L. no testis tissue. R. glandular testis tissue	Normal	Normal; many fresh corp. lut.
IX*	Feb. 2	Feb. 6		2	1	3	Apr. 22	L. flat testis rest like lentil. R. adhes. only	L. glandular testis tissue. R. no testis	Normal	Normal; many fresh corp. lut.
X*	Feb. 2	Feb. 6	Mar. 27				Apr. 22	R. testis rest like bean, L. testis like lentil	On both sides glandular testis tissue	Normal	Normal; many fresh corp. lut.
			Total	15	6	21					

*Successful transplantations.

ovaries, uterus and vagina); the microscopic picture showed many graafian follicles in different stages of their maturity, and many fresh corpora lutea, as a positive evidence of undisturbed ovulation (Fig. 7). We found generally the absence of changes on the other sex organs and mammary glands.

If we consider that notwithstanding the above findings, only four rats have given birth to litters (though all animals of this series have bred normally before their operation), we must conclude that the testis hormones, carried into the female circulation by the functioning

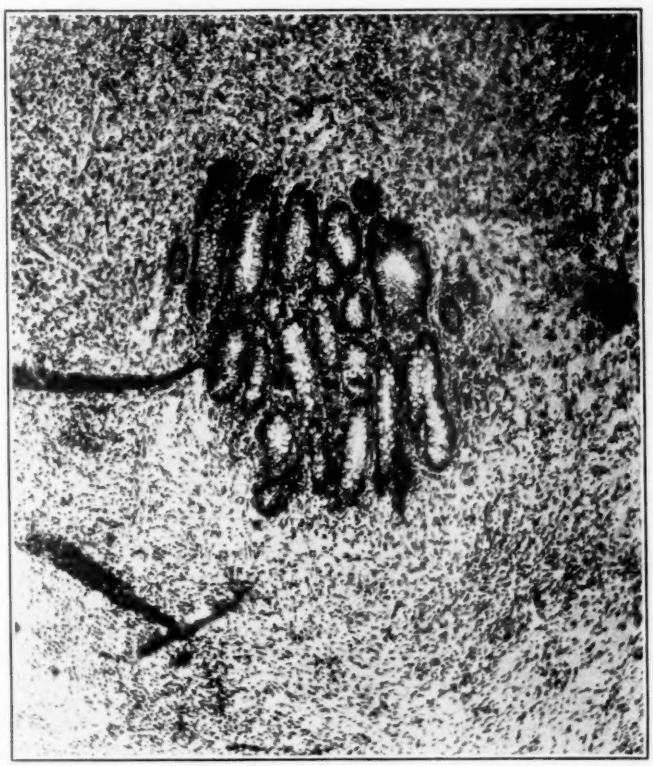

Fig. 1.—Transplanted testis gland on the abdominal wall, eighty-one days after operation. Rat No. VII, Table II. The gland canals are not filled with spermatozoa, but the epithelial and the interstitial cells are well preserved.

transplanted testis tissue, have effected sterility in six cases (60 per cent). But this actual sterility is not due to the hindering of ovulation. If we do not insist upon the theory that the male hormones effect the production of some kind of antibodies in the female organism against the spermatozoa, it might be supposed that the hormones damage in some way the vitality of the eggs. Thus only those ova which are endowed with exceptionally high vitality are able to develop successfully, while the rest, which possess only the average vitality, undergo degeneration at an early period of their development.

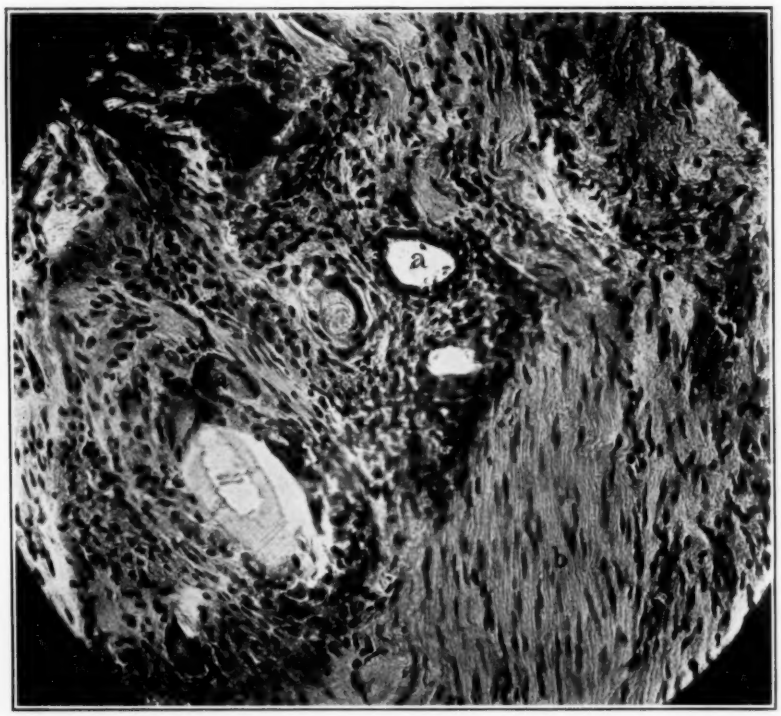

Fig. 2.—Transplanted testis gland of rat No. V, Table II, eighty-one days after operation. *a* are atrophic gland canals; *b* are abdominal muscles. Marked proliferation of interstitial cells.

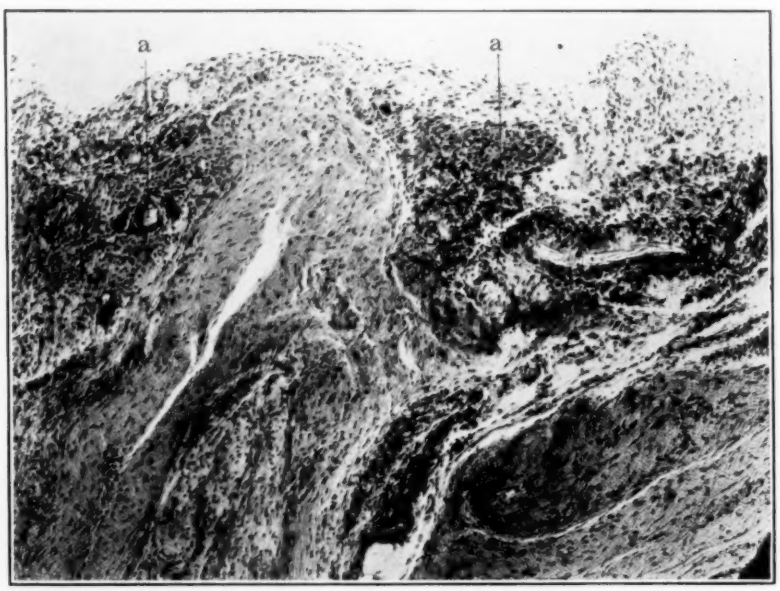

Fig. 3.—Transplanted testis of rat No. VIII, Table II, eighty-one days after operation. *a* are atrophic gland canals, but yet functioning testis tissue.

This supposition is confirmed by the fact that the average number of offspring for each rat in the third series of our experiments (transplantations, Table II) as well as in the second series (Table I) was 5.2, which is distinctly less than that of the normal (7 to 8). At any rate, it was impossible to state whether the effect of our treatment was due to an actual failure of conception or to abortion of the fertilized ovum in an early stage of development. Abortion does not occur in the lower animals as in woman by the elimination of the dead egg, but

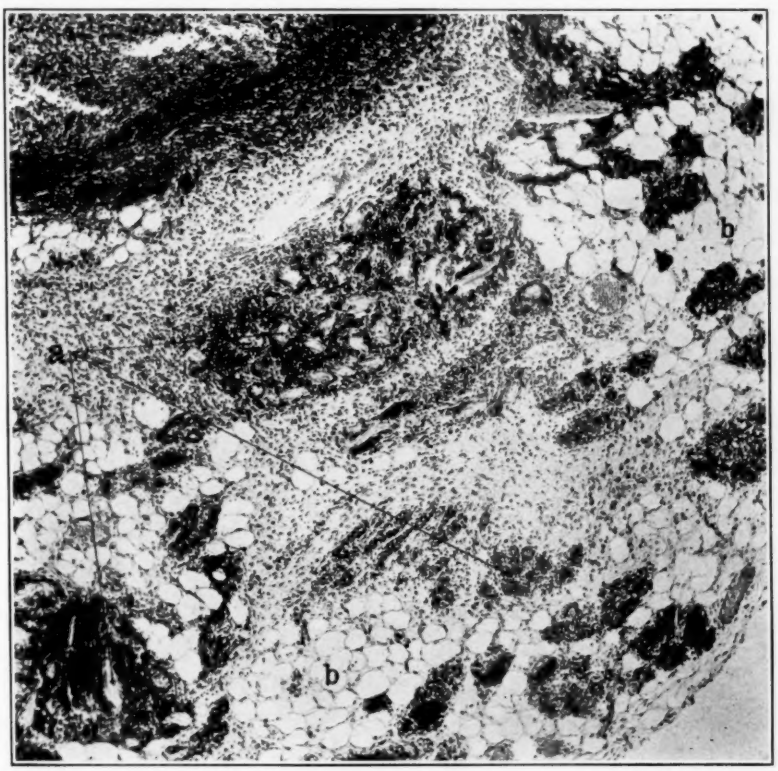

Fig. 4.—Transplanted testis gland on the abdominal wall, eighty-one days after operation. Rat No. VI, Table II. *a* are well-preserved, functioning gland canal groups; *b* the covering omentum.

the defective ovum is resorbed *in situ* after its death or is eaten immediately after its expulsion. This theory offers an explanation not only for the lower fertility but also for the change of the sex ratio of the offspring. It seems plausible to suppose that the testis hormones injure in the first place, the female eggs or embryo basis, consequently the birth rate of the male increases. Lillie has evolved a similar theory which was adopted later by Lewz and also Fetscher. According to them the hormones of the germ glands injure the germ cells of opposite sex character.

The offspring of our treated rats were perfectly normal. Neither were we able to observe any significant abnormalities in the habits of the animals who received the transplants except in the case of No. VI, Table II. This rat did not build a nest on the last day of its preg-

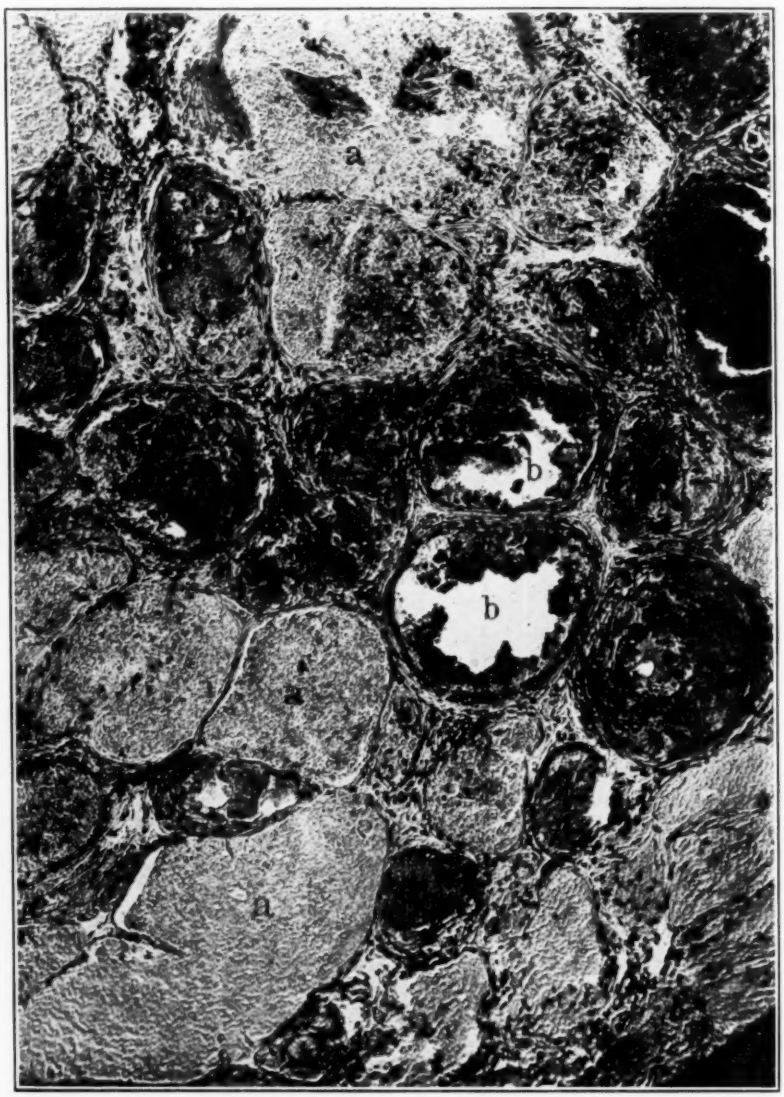

Fig 5.—Transplanted testis gland on the abdominal wall eighty-one days after operation. Rat No. X, Table II. *a* are obliterated, necrotic gland canals; *b* are atrophic but functioning canals without spermatogenesis.

nancy (as is the habit of the rat), neglected the suckling of its brood and at last ate them. As the same rat has brought up her former litter normally before operation, this change of behavior is probably due to the transplantation.

Our knowledge concerning the changes in the sex character produced by transplantation of the sex gland, the "masculinization" of the female and "feminization" of the male in that way and the artificial hermaphrodism respectively, is closely connected with Steinach,[31] who claims that a sex gland cannot be transplanted successfully into an adult animal of opposite sex, unless we have removed its own sex glands before the transplantation. For instance, if we transplant testis gland into the female and do not first remove the ovaries, our efforts will not succeed; the transplanted tissue will be entirely resorbed in a few weeks. Our experimental study neglect-

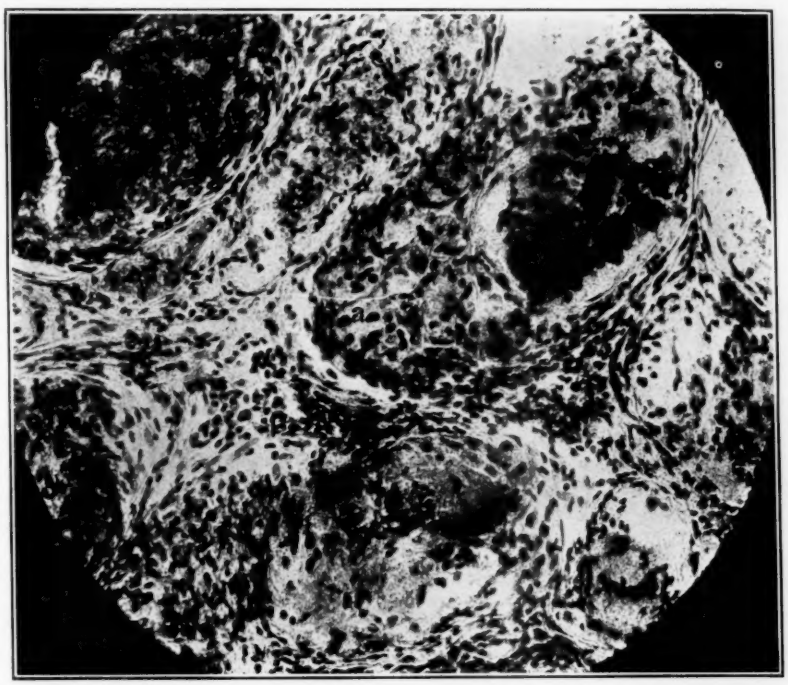

Fig. 6.—Strong magnification of Fig. 5. *a* shows atrophic canals and proliferating interstitial gland tissue. No spermatogenesis.

ing Steinach's principal biologic thesis, seemed the more hopeless, because we were not able to find any literature refuting this dogma. On the other hand we were encouraged by the experimental findings of Pezard and Foges (quoted by Steinach). These authors have implanted cock testis into hens, in whom they left a small part of their ovaries. In that way they obtained types with hermaphroditic character.

Analyzing our results, we must conclude that Steinach's dogma, concerning the antagonism of the gonads, is incorrect. The transplantations of testis into adult female rats without removing their ovaries, were not only successful in the greater part of our experi-

ments (60 per cent), but the internal secretion of the functioning transplanted gland has not injured the biologic function or morphologic structure of the ovaries at all. Moreover two of the successfully transplanted rats became pregnant (Cases VI and IX, Table II), gave birth to litters and one of them brought up its litter normally.

Fig. 7.—Ovary of rat No. VIII, Table II, eighty-one days after successful testis transplantation. Graafian follicles in different stages of development, fresh corpora lutea.

Let us summarize the effect of the transplantations upon the sex ratio of the offspring. Only in two cases of our rats operated upon which gave birth to litters later, were we able to prove, by histologic specimens, the presence of functioning testis tissue in the abdominal wall (Cases VI and IX, Table II, Fig. 4). But in the other two cases (Cases I and III, Table II), the slow resorption of the implanted testis tissue happened during the time in which the con-

ception occurred and the first stage of the development of the egg took place. Thus we can assume in these two cases the same hormonal influences upon the maturation of the egg and the development of the embryo as in the other two cases of successful transplantation.

The total number of the offspring in Table II, is twenty-one, fifteen of them were males and six females, a sex ratio of 250 males to 100 females. Although the value of these results is diminished by the smallness of the numbers, yet the difference in the proportion of the male offspring to the females is very great. It would, therefore, seem unreasonable to say that this increasing change of the sex ratio to the advantage of the male through all the three series of our experiments (normal 105.5 males: 100 females, first series 133 males: 100 females, second series 145.40: 100 females, third series 250 males: 100 females) is due to mere chance.

We are aware of the many faults of this paper due in part to limited means and time. Moreover, the above experiments are only the outlines of further research work on this important subject. The working out of this problem with a much larger number of animals on a broader basis, and extending the observations to the second generation of the animals impregnated with sex hormones, is the task of further investigations.

CONCLUSIONS

1. The sex ratio of the offspring of the albino rat can be changed to the advantage of the male by subcutaneous injections with testis tissue.

2. This change of the sex ratio can be increased in this direction if the treatment begins eight days before mating.

3. We obtained the greatest influence on the sex ratio by transplantation of testis into the female rat, performed before the mating.

4. The subcutaneous injections of testis tissue of the same species into the female rat effects a temporary sterility for a period of three to eleven weeks.

5. Steinach's dogma concerning the antagonism of the gonads is incorrect. A successful transplantation of testis into adult female rats can be obtained without first removing the ovaries. Such females can become pregnant, give birth to young and raise their litters normally.

6. The functioning testis tissue transplanted into the female has neither a significant influence on the biologic function nor changes the morphologic structure of the ovaries.

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CYSTIC LESIONS OF POSSIBLE ENDOMETRIAL ORIGIN IN THE APPENDIX. A REPORT OF FOUR CASES*

By Geo. W. Outerbridge, M.D., Philadelphia, Pa.

SOME years ago, during the course of considerable routine pathologic work upon specimens received from one surgical and two gynecologic clinics, there came under my observation four appendices showing rather remarkable and unusual lesions, in the form of cyst-like cavities of varying sizes, some empty, some containing apparently blood or other debris, some lying immediately in the muscular or serous coats of the appendix or in the mesoappendix, others being surrounded by a small amount of loose cellular tissue. All were in the outer layers, having apparently no relation whatsoever to the mucosa. All were lined by a single layer of columnar epithelium, varying somewhat in height in different instances, and all were associated with definite evidences of marked chronic or subacute inflammatory changes in the appendix. All occurred in women.

Case 1.—Appendix greatly and irregularly thickened, resulting in an eccentric position of the lumen and mucosa. (Figs. 1, 2, 3.) Situated at various points beneath the serosa and in the outer muscular coat of the appendix, and in the thickened serosa of the mesoappendix, were found cystic cavities of irregular size and shape, singly and in groups. Some of these were surrounded by the loose cellular tissue mentioned above. (Figs. 4, 5.) They were lined by moderately tall, columnar cells with central nuclei, occasional cells presenting a slightly vacuolated appearance. (Fig. 5.) One of the larger cavities was filled with blood, some of which has fallen out in preparing the section. (Fig. 3.) Associated conditions in this case were adenomyoma uteri, small parovarian cyst, perioophoritis with numerous adhesions to the surface of the left ovary and the formation of similar epithelium-lined spaces between the adhesions and the ovary, and also many such spaces in the outer layers of the ovary. At one point, the ovary was very closely adherent to the uterine adenomyoma.

Case 2.—Appendix showed some thickening of the submucosa with great prominence of the lymphoid follicles, and very marked thickening and fatty infiltration of the serosa at a point opposite the attachment of the meso. (Figs. 6, 7.) There was a marked inflammatory reaction in this area, and lying in this inflammatory tissue, or between it and the outer muscular coat, were several cavities similar to those in Case 1. They were less numerous, however, did not occur in groups, and did not show such a definite surrounding zone of loose cellular stroma. (Fig. 8.) Associated conditions,—myoma uteri, normal tubes, and ovaries.

Case 3.—Appendix showed considerable thickening of all coats, but most marked of the serosa, which in places was as thick as the muscular coats, and which showed extensive interstitial hemorrhage. Lying at one point in the thickened serosa, entirely outside the outer muscular coat of the appendix, was an oval cavity lined by a single layer of low columnar cells and containing some granular

*Presented at a meeting of the Obstetrical Society of Philadelphia, March 5, 1925.

material which took a pale blue stain in hematoxylin-eosin preparations. (Fig. 9.) Associated conditions,—uterine polyp, bilateral, multilocular, papillary ovarian cysts.

CASE 4.—Appendix showed subacute inflammation; serosa lustreless and deeply congested, mucosa swollen, hemorrhagic. At one point, marked thickening and fatty infiltration of the serosa similar to that in Case 2. In this region of the appendix, but lying in this instance between the inner and outer muscular coats, were four separate cystic spaces, lined by low columnar epithelium, surrounded immediately by the muscular coats, without intervening cellular stroma. (Fig. 10.) Associated conditions not known. (This specimen came from the general surgical clinic, and was the only structure removed.)

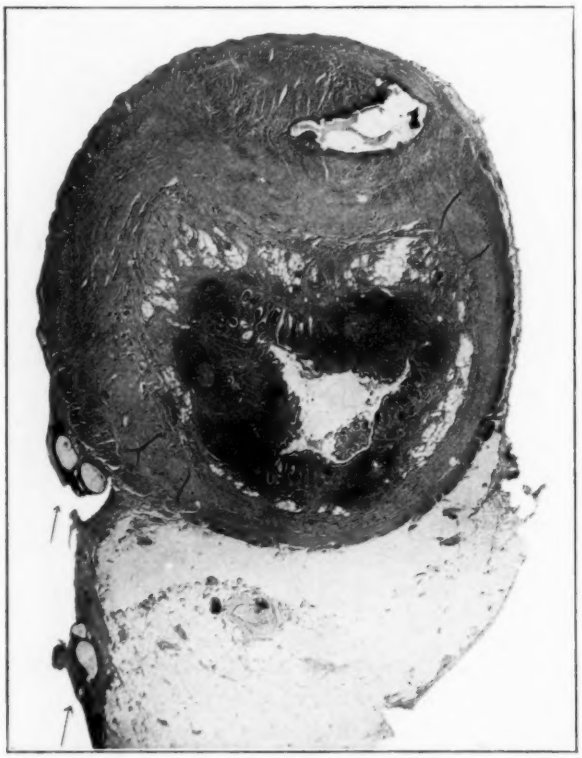

Fig. 1.—Case I. Low power, showing cystic areas in thickened outer muscular coat, and in serosa of appendix and mesoappendix.

These cases were demonstrated very briefly before the Pathological Society of Philadelphia at its meeting, February 8, 1917. At that time, I believed all these lesions were caused by proliferation and ingrowth of the surface endothelium *in situ*, with metaplasia of the cells into columnar type, the stimulation to such activity probably being derived from the associated inflammation.

With the appearance, in 1921, of the fascinatingly interesting work of Dr. Sampson,[1] however, and especially of his paper on *Intestinal Adenomas of Endometrial Type*[2] in the following year, in which four

Fig. 2.—Case I. Low power, showing cystic areas in thickened outer muscular coat.

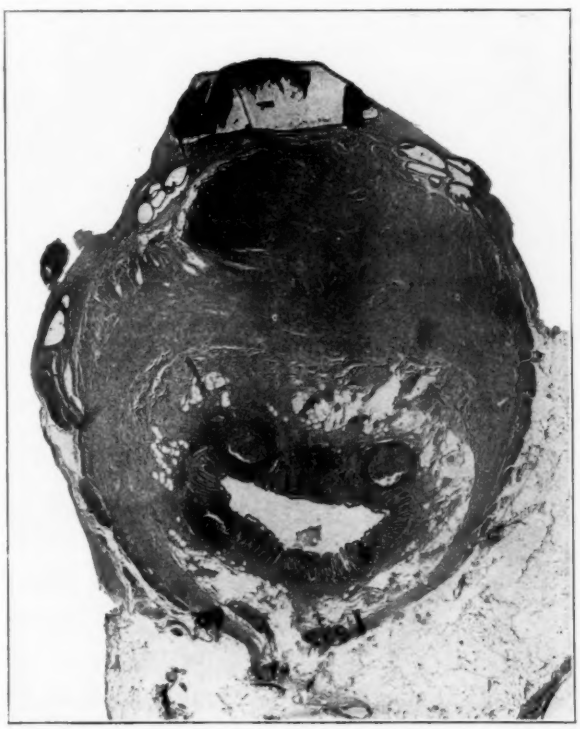

Fig. 3.—Case I. Low power, showing greatly thickened outer muscular coat, with numerous cystic areas, the largest containing blood.

appendices were illustrated having lesions apparently identical with those in my cases, it seemed evident that if Sampson's theories were correct in regard to his cases, they might probably apply to mine as

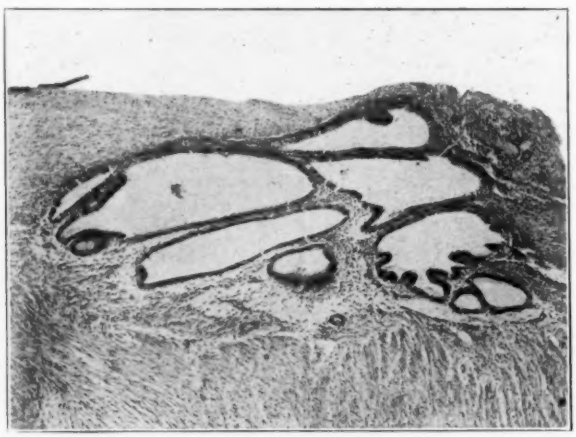

Fig. 4.—Case I. Medium power of one of the groups of cysts from Fig. 3, showing cellular stroma.

well. Comparatively few examples of this type of lesion in the appendix have been reported, at least, in comparison to those occurring in other localities. Thus Cullen,[3] (in a paper published before Samp-

Fig. 5.—Case I. High power of a portion of Fig. 4, showing character of lining cells and stroma.

son's first report) in speaking of ten situations, ranging from the rectovaginal septum to the umbilicus, and including one intestinal site (sigmoid) in which he has found adenomyomata, does not mention the appendix; and Mahle and McCarty[4] (also before Sampson)

in reporting ten cases of ectopic adenomata of uterine type, likewise found none in the appendix. More recently, Dougal[5] has reported one appendicial case, in which there was an associated chocolate cyst in one ovary; and in his latest paper, Sampson[6] has reported and illustrated an additional case of benign cystic involvement of the appendix of the type under discussion. Because of the comparative paucity of reports of these lesions involving the appendix, I feel justified in presenting the above cases, but it seems highly probable that in the future, now that our attention has been directed anew to the significance and possible correlation of adenomatous lesions in various

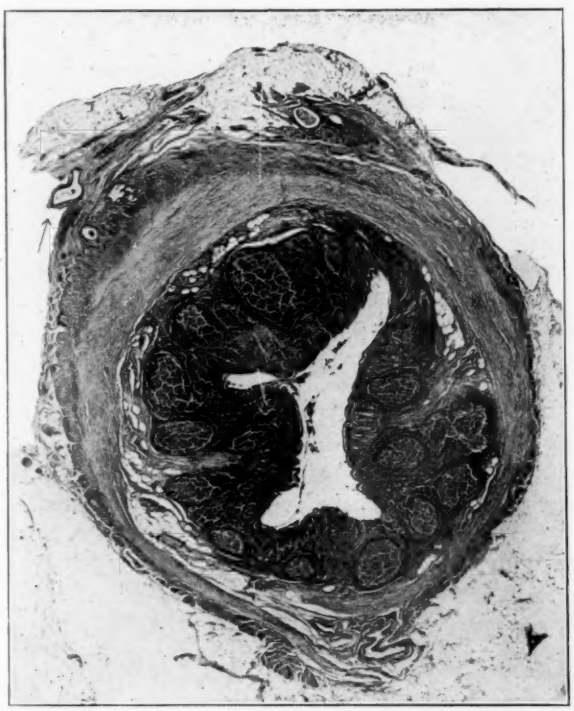

Fig. 6.—Case II. Low power, showing cystic cavities beneath thickened serosa.

portions of the abdominal cavity and adjacent regions, these cases will come to light with increasing frequency.

With regard to the etiology of the cases reported herewith, unfortunately the records are not as complete as might be desired, and even with the new points of view opened up by Sampson, I feel it is often difficult to come to a positive conclusion. In Case 1, the appendiceal lesions would seem almost certainly to be implantations of endometrial incidence; the close association with the uterine adenomyoma, the character of the cysts, (large numbers, considerable size, cytogenic stroma, blood contents), and the presence of similar ovarian lesions, would all point to this conclusion. In Case 2, the assumption is not so

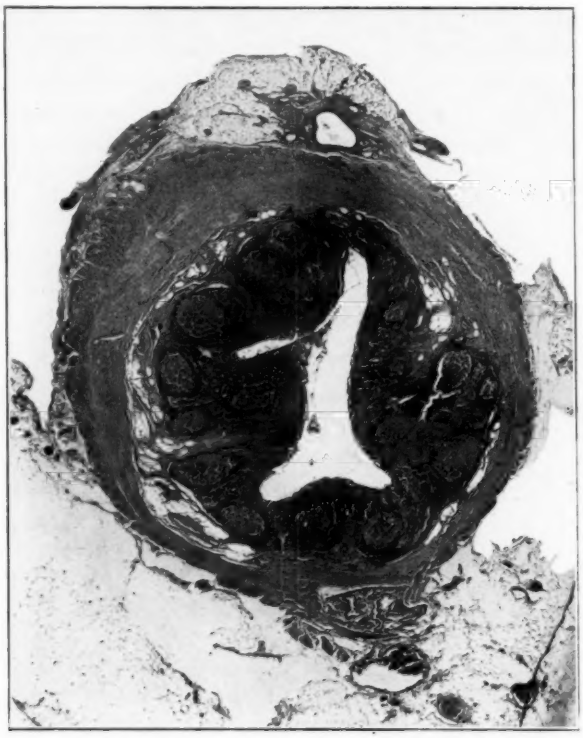

Fig. 7.—Case II. Low power, from another portion of the specimen.

strong; the tubes and ovaries were "normal," but as Sampson has pointed out, small ovarian lesions may be overlooked unless especially searched

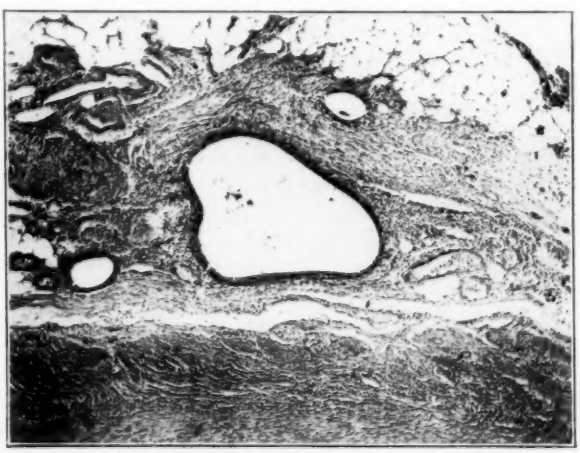

Fig. 8.—Case II. Medium power view of the cysts shown in Fig. 7.

for, and in any event, transplantation may have taken place directly from the tubes, without mediation of the ovary. On the other hand,

Fig. 9.—Case III. Low power, showing small cyst in thickened serosa.

Fig. 10.—Case IV. Low-medium power view of a segment of the appendix, showing thickened serosa, and four cysts lying between inner and outer muscular coats.

the cysts are so definitely in relation, so far as situation is concerned, to marked inflammatory changes in the serosa, that a considerable presumption must arise of their origin from ingrowth of the surface endothelium at that point. I feel that this case must be placed in what Dr. Sampson would call his "middle group"—i.e., cases in which a definite determination of etiology, whether from endometrial transplantations or from endothelial metaplasia, is impossible. Case 3, with the single small cyst limited to the greatly inflamed serosa, would seem pretty surely to be of endothelial origin, in spite of the presence of the associated papillary ovarian cysts. Case 4, again, must be considered as rather doubtful, largely because of lack of corroborative data one way or the other. The rather large size of the lesions, and their situation fairly deep in the appendiceal wall, would seem to me to speak rather for implantation than serosal origin, even in face of the inflammatory condition of the adjacent serosa.

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1927 SPRUCE STREET.

PURPURA COMPLICATING PREGNANCY*

By Stephen Rushmore, M.D., Boston, Mass.

THE occasion for the present study of purpura was the opportunity which came to me to see, in consultation with Dr. W. R. Basch of Boston, a pregnant woman in whom this complication was present.

The patient was twenty-nine years of age and was seen in the sixth month of her first pregnancy. Her general condition had been good in spite of much distress from nausea and vomiting in the early months.

About the beginning of the sixth month, the patient had what she described as an attack of bronchitis, with much coughing; she was stiff all over but not especially in the joints. She was not confined to bed nor did she consult her physician.

A little over two weeks after the beginning of the attack of bronchitis, the patient complained of marked itching of the ankles and noticed numerous red blotches, for which she called her physician at once. She was put to bed, the blotches spreading rapidly to cover perhaps one fourth of the surface of the legs and thighs. The itching was described as "terrible."

The patient was seen by me in consultation three days later, apparently in good general condition. She appeared rather pale with slight elevation of temperature. There were large areas of ecchymosis over the thighs and legs and feet and many smaller areas of hemorrhage down to pinhead petechiae. Some small ecchymoses and petechiae were present on the buttocks and lower back and a few were seen on the arms. Some of the spots appeared to be fading and it was said no new spots had appeared for twenty-four hours. There was no swelling of the joints and no history or traces of bleeding except into the skin. Two days later the patient miscarried spontaneously and completely, and convalescence was normal. The fetus was born dead, and showed no evidence of purpura.

The ecchymoses continued to fade, but about two weeks after the miscarriage there was swelling in the popliteal space on each leg, more on the right. There was no evidence of infection of joint or interference with the circulation of the legs. Convalescence was otherwise undisturbed. On December 31, menstruation occurred normally. Two months later the patient seemed perfectly well except that she said she became tired more easily than before the pregnancy began.

That this complication of pregnancy is infrequent is evident from the textbooks. In most of those consulted, no reference to it was found.

Hirst[27] says "Purpura hemorrhagica is generally rapidly fatal, always interrupting the pregnancy. The fetus dies before the interruption of the pregnancy." Kosmak[28] says: "Purpuric eruptions are sometimes noted in pregnancy, occurring either as occasional isolated hemorrhagic spots in different parts of the body, or as a more severe manifestation, associated with the advanced stage of pernicious vomiting or eclampsia. The former type is transitory, but in the other instance, the appearance of this symptom offers a grave prognosis. In such eruptions a differential diagnosis must be made between hemophilia and scurvy. Congenital hemophilia is rarely transmitted to females but if there is a familial tendency, the

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vessel walls are undoubtedly more susceptible to the destructive action of the pregnancy toxins. Scurvy is of course rarely met with in this country.''

Seitz[29] in Doederlein's *Handbuch* says: ''Purpura hemorrhagica has been described in pregnancy: it should be regarded only as a symptom. In addition to the small extravasations of blood in the skin, there are to be made out other changes, signs of severe intoxication. Thus purpura hemorrhagica is observed with hyperemesis and eclampsia. I have twice noted in parturient women that the whole surface of the body was covered with pin head ecchymoses, without noteworthy disturbances of the general condition. In the urine was a slight amount of albumin. In the puerperium the ecchymoses clear up rapidly. A few cases have come to autopsy and in addition to the hemorrhage into various organs and tissues of the mother, extensive fatty degeneration of the liver and kidneys was found.''

In reviewing the cases reported in the literature one is again impressed with the infrequency of purpura as a complication of pregnancy. Barnes'[1] communication was published in 1867 and a careful, though not exhaustive search has brought to light reports of only forty-six cases since that time, in a period of fifty-seven years. Because the clinical picture is so striking it is probable that no great number of cases has occurred without report or detection.

Another feature is the variety of clinical conditions with which purpura occurs, and of which it may be symptomatic.

The first case reported, that of Barnes,[1] is the only one in which there is a suggestion of ''rheumatism,'' or Schoenlein's disease. The patient at the onset of the disease in the sixth month of pregnancy began to complain of rheumatic pains in the joints, and of lumbar pain, accompanied by vomiting and fever. Labor ensued and a fetus was born that lived only three hours. On the day of delivery purpuric spots appeared on the abdomen, legs and face. There was much prostration and delirium with fatal outcome the following day. But even in this case there was no well-marked arthritic involvement.

Some of the cases strongly resemble scurvy, as that of Zangemeister[13]. In his case, the purpura preceded by two months the hemorrhage from the gums and mouth, which became worse in the month before delivery. The fetus died in the sixth month during birth. In one of the cases reported by Ferroni[26] the first symptom was odontalgia. Later there was a swelling of the gums which bled easily on slight pressure. Two days later there were blood stained movements, with great debility, and crops of small, wine-red spots appeared on the skin of the neck, extending over the rest of the body and extremities. The patient left the hospital in sixteen days, the stomatitis cured and the pregnancy undisturbed.

The occurrence of hemorrhagic disease in mother and fetus is noted seven times. In Dohrn's case,[4] the petechiae which were present in vast numbers during the pregnancy had disappeared at the time of delivery. The fetus, a female, born in the ninth month, showed cutaneous hemorrhages ''perfectly identical'' as to number, size and color with those of the mother when she was admitted to the clinic. The appearance of some of the spots indicated an origin shortly before birth. No new extravasations appeared except on the second and fifth days when small areas of hemorrhage were visible in the conjunctivae and hard palate.

In the case reported by Mosher[22], a live child was born. Though it seemed well-developed and vigorous, large ecchymoses developed wherever it was touched and it died in ten hours.

In the cases reported by Hanot and Luzet[11], and by Zangemeister[13], of hemorrhage in both mother and fetus there was no hemorrhage into the skin of the fetus, though numerous foci were found in the internal organs. The case of

Hanot, was fatal streptococcus septicemia with purulent cerebrospinal meningitis of the mother.

That there may be a psychic or nervous element involved is strongly suggested by the case reported by Puech[5]. The patient, twenty-one years of age, had always been in good health. In the sixth month of her first pregnancy, following a violent attack of anger, the patient began to feel languid and suffer from palpitation. On the fourth day there were noted petechiae on the extremities, chest and abdomen. On the thirteenth day, following elevation of temperature, the patient fell into labor. The petechiae increased in number, hematuria, hematemesis and epistaxis occurred. Labor was normal, but bleeding continued and the patient died from exsanguination on the second day of the puerperium.

A glance at the outcome of the pregnancy indicates the seriousness of this complication for the mother. Recurrence in repeated pregnancies is therefore the more remarkable. The case reported by Greenhill[23] is of this character. The first pregnancy terminated normally, after there had appeared a "simple type of purpura hemorrhagica" at the beginning: hemorrhage from mucous membranes of nose and gums occurred with petechiae and ecchymoses on extremities, chest and abdomen. In the second pregnancy, two years later, there was some bleeding from the nose and gums (the case was reported while pregnancy was in progress). Hemorrhages on the extremities and trunk rapidly occurred after very slight trauma; for example, the cuff of the blood pressure apparatus produced ecchymosis. The patient was in good general health at the time of the report.

In the case of Vignes and Stiassnie[17], purpura occurred in three pregnancies over a period of about ten years. Following the third confinement, a thorough examination of the blood was made: the findings were normal except for a positive Wassermann.

A coincidence reported by Wiener[9] is worthy of remark. Wiener's patient was a primipara, aged twenty-four, in whom pregnancy terminated in the seventh month. Twelve days later petechiae were noted on the patient's neck and the urine was slightly blood stained. Two days after the beginning of the eruption, severe headache occurred: face, neck and trunk were covered with scarlet petechiae, other symptoms were conjunctival hemorrhages, blood-stained sputum and intense hematuria, the gums were normal. The patient soon died. Going into the history of this patient it was learned that she had been in attendance on a sister who had been pregnant and who had died of the same disease fourteen days before.

The sister was thirty-two years of age; quadripara, in the sixth month of pregnancy. On March 6, 1887, she complained of headache and lumbar and abdominal pain. On March 9, there was considerable tenderness over the liver; no enlargement of spleen; temperature 39.8° C.; pulse 100. On March 10, red petechiae were seen scattered over the arms and chest; other symptoms were conjunctival hemorrhages, hematuria and chocolate-colored sputum. Spots extended to face, neck, thighs and became purple in color; labor; postpartum hemorrhage and death.

My case belongs to the group known as simple purpura, in which there is hemorrhage into the skin only. But, it is peculiar in this respect, that the patient complained of "terrible" itching. There was, at the time she was seen in consultation, no evidence of urticaria, or any eruption except the petechiae and ecchymoses, neither was there history of any other change in the skin. But the intense itching suggests strongly that the case belongs with the urticarias or angioneurotic group. It followed an infection (bronchitis) and was accom-

panied by fever and increased pulse rate. In this connection, the spontaneous termination of pregnancy is especially interesting. It is the only case of pregnancy complicated by this form of purpura noted in the literature.

A study of the cases of purpura not associated with pregnancy gives rise to much the same sense of confusion that a consideration of the cases with pregnancy had produced. Classification is unsatisfactory but Pratt[24] has suggested the following groupings as convenient: (1) primary or idiopathic purpura; (2) purpura in acute infectious disease; (3) purpura in chronic disturbances of nutrition; (4) senile purpura; (5) toxic purpura; (6) nervous purpura; and (7) mechanical purpura.

Purpura of pregnancy may belong to any of these varieties, except the senile, and may be found in more than one group at the same time. It is the idiopathic forms of disease that are perhaps the most interesting for they represent the group about which we frankly acknowledge that we know the least.

Minot and Lee[25] introduce their discussion of hemorrhagic diseases and conditions with the following remarks:

"The definite hemorrhagic diseases are idiopathic purpura hemorrhagica, hemophilia and hemorrhagic disease of the new born. The etiology of these diseases is unknown, though a defect of some factor of the blood, associated with the production of blood, is recognized. There are also certain ill-defined cases of primary hemorrhagic disease in which a blood defect of somewhat similar nature is not clearly demonstrable but may be assumed to exist.

"There is also a disease condition, usually known as idiopathic purpura, which is to be differentiated from idiopathic purpura hemorrhagica. Idiopathic purpura occurs in various forms and in general seems related to urticaria, erythema and angioneurotic edema. Hemorrhage occurs particularly into the skin, and bleeding occurs relatively rarely from other parts. Idiopathic purpura is usually classified under the hemorrhagic diseases because of its resemblance to the more clear-cut forms of hemorrhagic disease. However, the hemorrhagic condition would appear to be particularly dependent on a focal alteration of the blood vessels, which in turn may well be dependent in part at least upon unrecognized changes in the blood.

"Purpura or hemorrhage into the skin is often a conspicuous symptom of hemorrhagic conditions but its causes are manifold. In some cases purpura is due to abnormal condition of the blood; but more commonly it does not indicate a recognized disturbance of the blood.

"Pathologic hemorrhage, besides occurring in disease entities, frequently occurs in a considerable variety of conditions as a secondary manifestation, due apparently in some cases to defect of the blood associated with the production of hemorrhage, and in others apparently to local vascular changes. Though hemorrhage may be due to some blood abnormality, it is usually due to a local condition."

Purpura hemorrhagica is further defined "as that condition associated with marked diminution of the blood platelets, in which there is spontaneous bleeding from some mucous membrane, usually with purpuric skin lesions." The bleeding time is prolonged.

"It is not to be confused with other types of purpura or scurvy, which have an essentially normal number of platelets," nor with hemophilia, in which the platelet count is normal and the coagulation time is prolonged. The idiopathic type may be considered for the present as constituting a disease entity, "other names for which are pseudohemophilia, Werlhof's disease, essential thrombopenia and idiopathic paucity of platelets." The symptomatic type is associated with

many diseases as for example; pernicious anemia, leucemia, tuberculosis, nephritis and infections.

The best composite picture of the clinical course of pregnancy complicated by purpura is given by Mosher[22] as follows.

"The victim is usually a multipara. Her age is from twenty-two to thirty-five years. The patient shows at first the appearance of good health, and the family history may be negative. Her former pregnancies have been normal and each one terminated with the birth of a full term living infant. Her present pregnancy may have been normal or there may have been a complication of metrorrhagia of sufficient importance to attract attention, when the woman finds herself again *enceinte*. The beginning of the pregnancy is not marked by any serious accident. At this time she may have noted a peculiar odor which seems to come from a fermentation of gastrointestinal origin. To all appearances, however, she is in good health and her gestation shows no untoward symptoms until some time in the sixth or seventh month she experiences a vague discomfort, loses appetite, and complains of headache; she has palpitation and gastrointestinal trouble which becomes more marked. Some time later there appear hemorrhagic spots on the skin, then petechiae, which are at first discrete, but later become confluent. These spots usually appear in successive crops. The woman finds that her gums are tumefied and painful and begin to bleed; epistaxis becomes troublesome; she usually has a persistent diarrhea; she consults a doctor, who finds that the fetus is living, but that the mother has purpura with symptoms of grave character. The patient is usually pale and depressed, short of breath, although no abnormal symptoms can be found in the heart, lungs, or other organs. Blood pressure may be normal, the pulse is rapid, corresponding with that of a light fever. A trace of albumin is usually found. She may improve but the reverse is generally the case. Gastrointestinal troubles increase. Mucous hemorrhages are frequent. The patient bleeds from the mouth, the nose, the bladder, and the rectum. She becomes rapidly anemic and exhausted, is confined to her bed. Hemorrhages increase from all mucous surfaces, the temperature rises. She goes into rapid labor, without great pain. She is delivered normally and may begin to improve. Generally, however, she dies after a few hours or a few days because, for some reason, the organism cannot reestablish itself after expulsion of the products of conception."

It has been claimed that pregnancy disposes to purpura. There is no evidence on this point that is conclusive, and little that is suggestive. There is no characteristic deviation from normal in the blood platelet count in pregnancy, or increase in the bleeding time, or diminished retractility of the clot. Such changes as are found in the blood in pregnancy may or may not have any bearing on the unknown factors which give rise to purpura. The chief evidence is that, in general, pregnancy has a depressing effect on the maternal organism, involving an increased load on the metabolic and eliminative activities. A few cases have shown prompt recovery after the termination of the pregnancy, and in the recurrent cases, purpura was present only in pregnancy.

In the absence of knowledge of the cause of purpura the treatment is symptomatic. If there is a deficiency of blood platelets these can be increased by transfusion of blood which may have to be repeated. The effect is temporary but it may tide the patient over some sort of

CASE NO.	AGE	NO. OF PREGNANCY	MONTH OF PREGNANCY	RESULT	
				Mother	Child
1 Ferroni	31	4	7	D	W
2 "	28	4	8	D	D
3 "	37	8	3	W	D
4 "	34	6	4	*	*
5 "	21	2	6	*	*
6 "	34	6	8	W	W
7 "	32	4	9	D	W
8 "	39	9	6	D	D
9 "			7	D	D
10 "			6	D	D
11 Barnes		2	6	D	D
12 Byrne	30	2	7	D	W
13 Dohrn	28	2	5	D	D
14 "	27	2	5	D	D
15 "	42	2	9	W	W
16 Puech	21	1	6	D	D
17 "	30	5	8	D	
18 Kezmarsky	30	3	Early	W	D
19 "	26	2	9	W	W
20 "	39	11	9 ?	W	D
21 "	29	2	8 ?	D	D
22 "	28	2	6 ?	D	D
23 Grazzini	43	6	9	W	W
24 Brieger	32	3	9	D	W
25 Wiener	24	1	7	D	D
26 "	32	4	6	D	D
27 Phillips	32	7	9	W	W
28 Hanot	22	1	9	D	D
29 Chambrelent	25	5	9	W	W
30 Zangemeister	36	1	6	W	D
31 Diehl		6	5	D	D
32 Buffen			9	D	D
33 "	25		9	D	D
34 Van Sweringen	29	1	9	W	W
35 Vignes	30	3	9	W	W
36 Merlini	32	5	7	W	D
37 Leclerc	22	5	6	D	D
38 Rudaux			7	D	D
39 Khitroff			2	W	W
40 "			8	W	W
41 "	21	3	8	W	W
42 Moscher	36	6	7	W	D
43 Greenhill		2	5	*	*
44 "	18	1	7	D	D
45 Phillips	29	1	6	W	D
46 "	21		6	D	D
47 "	30	5	8	D	

D—Died; W—well; *—Pregnancy undisturbed at time of report.

Cases 1 to 33 have been transcribed from Ferroni[26] who made an exhaustive study in 1903. Cases 46 and 47 are mentioned in Phillips'[10] original paper but are not transcribed by Ferroni. The references as well as the abstracts of Ferroni have been checked whenever the originals were accessible.

crisis until the recuperative power of the body is restored. The diseased condition with which the hemorrhages are associated should receive careful attention and may be susceptible to more specific treatment.

It is not possible to reach a satisfactory conclusion as to artificial termination of pregnancy, because the number of cases is so small. But it is my opinion at present, that the possible benefits to be derived

from getting the fetus out of the uterus do no compensate for the increased risk of hemorrhage at or following childbirth. In any case, at the time of delivery, preparations should be made for immediate transfusion if it becomes indicated, and the patient should be watched with the greatest care during the first week of the puerperium.

A thorough review of the literature on the subject discloses a total of forty-seven cases, which may be summarized as follows:

There were 44 cases in which the final result for the mother was reported; of these 26 mothers died and 18 remained well. Of 42 cases in which final result for the child was reported, 27 children died and 15 survived.

The age was noted in 38 cases as from eighteen to forty-three. Under 20: 1; 21 to 25: 10; 26 to 30: 13; 31 to 35: 8; 36 to 40: 5; 41 to 45: 2.

The number of pregnancies was noted in 39 cases: I: 7; II: 10; III: 4; V: 5; VI: 5; VII: 1; VIII: 1; IX: 1; XI: 1.

The months of pregnancy were as follows: Early: 1; II: 1; III: 1; IV: 1; V: 4; VI: 2; VII: 8; VIII: 7; IX: 13.

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520 COMMONWEALTH AVENUE. (*For discussion see page* 590.)

THE TREATMENT OF UTERINE FIBROMYOMATA*

BY JOHN G. CLARK, M.D., AND FRANK B. BLOCK, M.D.,
PHILADELPHIA, PA.

(From the Department of Gynecology, University of Pennsylvania)

IN this paper, it is our purpose to record the present opinions of the staff of the Gynecological Department of the University of Pennsylvania concerning the treatment of uterine fibroids, as well as the experiences that have caused these opinions to be formed. In the beginning of the consideration of treatment for these common tumors, it is well to remember that, as Neill so well expresses it, there are three plans in the treatment of fibroids, (1) operation, (2) irradiation, (3) let alone and observe. "Where there is no obvious disturbance to health, present or threatened, it is safe to advise the 'let alone' plan; the mere fact of the discovery of a tumor is not a sufficient indication for operation, as many believe." It is interesting to note that as recently as 1891, Goodell taught his students in the University of Pennsylvania that the treatment of fibroids consisted of hypodermic injections of ergot, or Atlee's operation of incising the capsule of the tumor by means of a knife introduced through the cervical canal, after which the tumor was dislocated and avulsed from its bed. If these methods failed, then bilateral oophorectomy was the procedure of choice, and as a last resort, hysterectomy, a "heroic operation" often employing the serrenoeud, could be tried. At that time, Keith reported a series of

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thirty-eight hysterectomies for myoma with three deaths, which was the best report on record and was considered phenomenal.

When the operation of hysterectomy without drainage was accepted by the profession, the treatment of uterine fibroids was thought to have reached its final resting place, to have become so standardized that brave, indeed, would he have to be who would try to produce equal results with any other form of treatment. The mortality of the operation had dropped so greatly and the end-results were so satisfactory that it was only logical that it should take some epoch-making discovery to change the accepted and standardized treatment. The medical profession, at least the greater part of it, is notoriously conservative in giving up the old and taking on the new, and we, as well as our patients should be grateful that this is so. With the advent of radium as a therapeutic measure, naturally there was much distrust and skepticism concerning its value, and the pioneers in this field, to whom much credit must be given, were greatly hampered in their work by unpleasantly promising accounts of radium in the press, many of the articles being embellished according to the tastes of the particular editor in charge. At all events, conservatism of the profession, seemingly exaggerated press notices, and finally the extraordinarily high cost of the element all worked against its early widespread use.

The question naturally arose as to how radium could imrove the results over hysterectomy, which had become so standardized that the postoperative morbidity was slight, while the operative mortality had been reduced to below 2 per cent. It is curious how the profession will take a figure such as this, which may represent the mortality in the large clinics in the hands of the most experienced surgeons, whereas the mortality in average hands, and it should be remembered that average hands do the largest part of surgery that is done today, may be thrice what the best clinics can show. Those who worked with radium in its early days quickly became aware of its remarkable hemostatic action, in fact, as we know radium today, that is its most useful as well as its most dependable property. It was soon learned that radium applied to the uterine cavity in sufficient strength would almost surely bring on an artificial menopause. How radium does this has not been definitely determined to this day, as one group of observers insist that this action is due to an obliterative endarteritis of the small uterine vessels, while another group are equally certain that the effect is produced by an ovarian atrophy, resulting from the irradiation. Without going into this discussion, all observers agree on the result: namely, cessation of uterine bleeding. One of the arguments frequently presented against the use of radium is that uterine myomata are prone to undergo malignant change or are frequently associated with carcinoma of the fundus, and that by leaving the

uterus in the body, the malignant growth may continue and later cause the patient to become inoperable. As will be seen later, the incidence of carcinoma of the fundus in this series was less than 1 per cent, while sarcoma of the uterus occurred in less than 0.25 per cent. These figures only serve to strengthen our previous views that the incidence of malignancy is a negligible factor, and can usually be diagnosed by the preliminary curettage, which is our routine. The advantage to be gained by the use of radium is merely one of decreasing an already low operative mortality, and greatly decreasing the existing operative morbidity. Naturally, the early workers in this field, being pioneers, had to blaze the trail for those to follow, and mistakes were made, as mistakes will always be made in the gradual standardization of any new process. At the present time, however, radium is not much of a stranger to many clinics, and by careful observations and records, we know with a fair degree of accuracy just what to expect from various sized doses and, what is most important of all, when *not* to use radium. In almost every article dealing with this subject which has come from our department, the contraindications to the use of radium in the treatment of uterine fibroids have been presented, but we feel so keenly that it is of more importance to know when not to irradiate than when to irradiate that with the feeling of tiresome repetition, it is deemed of value to present the negative side of the question. Briefly, the contraindications to irradiation are: (1) Tumors larger in size than a four months' pregnant uterus. (2) Tumors complicated by adnexal disease either neoplastic or inflammatory. (3) Tumors causing pressure symptoms, which respond too slowly to irradiation to give quick relief. (4) Cachexia out of proportion to the blood loss, which is suggestive of necrosis of the tumor. (5) Large submucous tumors. (6) Rapid growth of the tumor. (7) Patients under thirty-five years of age except in occasional cases. It is readily seen that with so many contraindications, the field of radiotherapy will be held within rather narrow limits, but we feel that if radium is applied only where clearly indicated, the results will be most satisfactory to all concerned. It is obvious, therefore, that such treatment should always be given by a gynecologist who, at a moment's notice, can proceed with a hysterectomy, if the examination of the patient under anesthesia shows some contraindication to radium which was not found previously. While a carefully graduated dosage can cause diminution of the menstrual flow without a complete menopause, it is in women who are over forty years of age where a full menopause dosage can be given, that radium reaches its best purpose.

While our own experience in the use of radium is sufficiently satisfactory in suitable cases for us to continue its use, it is interesting to note that almost without exception, those who have sufficient radium

as well as sufficient training in its use, have been most enthusiastic over their results. Watkins treated 275 fibroids with radium, reporting cystic degeneration of the ovaries following the treatment in only 2 cases. In only 6 cases did the treatment have to be repeated. Burnam is so enthusiastic about radium that he irradiates some tumors of very large size, much larger than we deem suitable for irradiation in our clinic. He has reported his results in 30 cases, which varied in size from a four to seven months pregnancy, all of which were irradiated five years previously. In 15 cases the size of the uterus became normal, and in 4 others it was reduced to the size of a six weeks pregnancy, and in no case of that group has the growth recurred. In the other 11 cases, complete amenorrhea was secured, but there was only slight reduction in the size of the tumor, while in 2 cases the tumor grew again. We mention this work of Burnam with large fibroids to show what has been done by one well supplied with radium, but excepting where operation is absolutely contraindicated, we should prefer to operate upon such cases. If radium is reserved for women approaching the menopause, there need be little concern as to the possibility of future pregnancy. Occasionally, however, it may be advisable to use radium in a case where a possible future pregnancy is greatly desired, and we should have some knowledge of the possibility of pregnancy following irradiation. Pemberton states that the percentage of miscarriages is greater in irradiated than in normal mothers, but no one has reported the birth of a deformed child and only a few undeveloped ones are found. In his series of 25 married women treated with radium for bleeding, 4 reported pregnancy subsequently, 2 going to full term, 1 had a premature labor at seven and one-half months, and the other miscarried at three and one-half months. Therefore, it is evident that normal childbirth can follow irradiation. Our experiences with small dosage irradiation are very similar to those of Pemberton. Pregnancy will scarcely ever follow when full dosage is used.

SURGICAL TREATMENT

Having considered the type of cases in which radium is indicated, it will be seen that there is a large field remaining for the employment of surgical means. In such cases the question will come up as to the advisability of myomectomy (removal of the tumor alone) or hysteromyomectomy (removal of the tumor and the uterus). As in the case of irradiation, each of these operations has its own field of usefulness. Lockyer regards myomectomy as having a greater risk than hysterectomy, but feels that this should be ignored if there is a chance of subsequent childbearing. Miller records 50 cases of myomectomy with 2 per cent mortality and of the 35 cases traced, there was one recurrence of the tumor (2.8 per cent). Ninety-five per cent of the patients

menstruated normally after the operation. An impartial review of the recent literature will convince any one that at the present time myomectomy carries no higher mortality than hysterectomy, and is followed by pregnancy in a sufficient number of cases to warrant its use in young women, especially when the growth is single and intramural or subperitoneal. If hysteromyomectomy is the operation of choice, as it should be in the majority of cases not suitable for irradiation, should the operation be by the vaginal or abdominal route, and should it remove the entire uterus or only the supracervical portion? We rule out vaginal hysterectomy as being unsuitable except in the very rare cases where there is a small tumor and associated prolapse as it has no advantage over the abdominal operation, and is attended by poorer exposure and greater trauma. In answer to the question of the advisability of performing the total or the subtotal hysterectomy, we unhesitatingly advise the subtotal as the method of choice unless the cervix is badly diseased. We are fully aware of the claims made by the "totalists" that the retained cervix is apt to undergo malignant change and that the mortality of the total operation is no greater than that of the subtotal. However, our experience has failed to show carcinoma developing in the retained stump to be of sufficient frequency to warrant the total operation as a routine, because we are convinced that the total operation carries both a higher mortality and morbidity than the supravaginal operation. Black estimates that in the hands of the average surgeon the total operation has a mortality of 9.44 per cent, while the subtotal has only 5.29 per cent mortality. While these figures are undoubtedly higher than those of large clinics, the relative values are probably much the same in most clinics. Lockyer reports 195 total operations with 3 deaths (1.54 per cent) and 284 subtotal operations with 5 deaths (1.76 per cent), and on these figures bases his preference for the total operation. However, he states that he prefers the subtotal operation in all difficult cases. We repeat, however, that in our clinic as well as in our teaching, in the absence of well marked indication for removal of the cervix, the subtotal hysterectomy is looked upon as the operation of choice.

We have avoided mentioning roentgenotherapy, because with radium, myomectomy, and hysterectomy at our disposal, it is indeed an exceptional case that we relegate to the roentgenologist. Such a case would be one with a growth too large for radium and having a marked contraindication to operation on account of some constitutional condition.

ANALYSIS OF MYOMATA TREATED IN GYNECOLOGICAL DEPARTMENT OF UNIVERSITY HOSPITAL DURING PAST THREE YEARS

Clark and Keene presented an analysis of the results of irradiation in benign uterine bleeding, based on all the cases irradiated in our

department up to August, 1921. That series included all types of benign uterine bleeding such as myopathic hemorrhage, menarchial hemorrhage, chronic metritis, etc., and no mention was made of the operative treatment. In the present paper, in order to determine our recent experiences with myoma of the uterus, we have included every case of uterine fibroids which has been admitted into our service in the University Hospital from January 1, 1922, to December 31, 1924, and have *excluded* all other types of benign hemorrhage, so that we are dealing absolutely with the treatment of uterine fibroids. During this three-year period there were 436 cases of myoma uteri admitted to our service for treatment. We have excluded one case of ovarian carcinoma, complicated by a fibroid uterus which died after only an exploratory laparotomy. Of the 436 cases, in 14, operation was refused or delayed on account of some constitutional contraindication. Of the remaining 422 cases, 267 (63.2 per cent) were subjected to operation and 155 (36.8 per cent) were irradiated. Of those irradiated, in 2 cases the x-ray was used, all of the others being subjected to radium rays. A glance at Table I shows that the tendency has been toward operation rather than irradiation as evidenced by the fact that, in 1922, 58.1 per cent of the cases were operated upon; in 1923, 59.7 per cent; and in 1924, 70.1 per cent.

TABLE I

METHODS OF TREATMENT

	1922	1923	1924	TOTAL
Total number applying for treatment	135*	131	170	436
Treatment refused or delayed	6	2	6	14
Number treated	129	129	164	422
Number of operations	75*	77	115	267
Percentage of operations	58.1	59.7	70.1	63.2
Number of radium irradiations	54	51	48	153
Number of roentgen irradiations	0	1	1	2
Total number of irradiations	54	52	49	155
Percentage of irradiations	41.9	40.3	29.9	36.8

*Does not include one exploratory laparotomy in a case of ovarian cancer complicated by fibroid, which resulted in death. The operation was only exploratory.

In dealing with a statistical study of this sort, it is often difficult to determine which cases to include, as many cases of uterine fibroids are complicated by other lesions in the pelvis (in this series 36.7 per cent), in many of which the associated condition is more important and really constitutes the cause of illness. In order to avoid criticism of the method of case selection, we have included every case in which a fibroid uterus was present, no matter how little it may have had to do with the symptomatology. Table II shows the associated lesions in this series, pelvic inflammatory disease holding first place as a complicating factor and ovarian cysts (simple retention cysts excluded) an important second place.

TABLE II

COMPLICATING PELVIC LESIONS OF CASES OPERATED UPON

	1922	1923	1924	TOTAL
None	40	46	69	155
Marked intraligamentary	5	3	6	14
Ovarian cyst	8	9	13	30
Pelvic inflammatory disease	21	10	22	53
Carcinoma of fundus	0	2	2	4
Carcinoma of ovary	1	2	1	4
Pregnancy	0	3	1	4
Carcinoma of cervix	0	1	0	1
Sarcoma of uterus	0	1	0	1
Stricture of sigmoid	0	0	1	1
Total	75	77	115	267
Percentage of total which were uncomplicated by other disease	53.3	63.6	65.2	63.3

An analysis of the types of operations performed has been made for each year and shows that our tendency has been to do more myomectomies and fewer total ovarian ablations. The ovaries are usually conserved if healthy unless the patient is well past the menopause. In this entire series, in only 20.6 per cent were both ovaries sacrificed, nearly half of these being in cases of associated pelvic inflammatory disease. If lutein tissue is present in the ovary, we prefer to conserve it irrespective of the patient's age, as the ovary is still functioning. Table III shows the types of operations performed in the uncomplicated cases, and in explanation of vaginal hysterectomy it should be stated that this is only done in cases where there is an associated uterine prolapse, which is repaired at the same time. Table III also shows that supravaginal hysterectomy with conservation of both ovaries is our operation of choice, having been done in 36.5 per cent of cases, or more than twice as frequently as supravaginal hysterectomy with bilateral oophorectomy. Table IV analyzes the morbidity and mortality, showing that wound infection (5.2 per cent) is the commonest complication, with pelvic peritonitis (3.7 per cent), pulmonary embolism (1.8 per cent), postoperative pneumonia (1.1 per cent), phlebitis (0.7 per cent) and general peritonitis (0.7 per cent) in their order of frequency. When speaking of mortality, we find that if we considered only the uncomplicated myomata, there was no death in any of the 169 operative cases, and 155 irradiated cases, or, in other words, 324 uncomplicated myomata have been treated by appropriate measures without a death. On the other hand (Table V) in the series of 98 cases of fibroids associated with other pelvic lesions there were 3 deaths, or a mortality of 3 per cent, so that the mortality of the treatment of fibroids in our hands has been entirely due to complicating disease. Taking all the operative cases, even including the exploratory laparotomy previously mentioned, the mortality of the operative group was 1.4 per cent. Excluding this exploratory laparotomy, the mortality was 1.1 per cent. One of the deaths was

TABLE III

TYPES OF OPERATIONS IN UNCOMPLICATED CASES

	VAG. MYOMECTOMY	ABD. MYOMECTOMY	SUP. VAG. HYSTERECTOMY BILAT. OOPHORECTOMY	SUP. VAG. HYSTERECTOMY UNILAT. OOPHORECTOMY	SUP. VAG. HYSTERECTOMY OVARIES RETAINED	PANHYSTERECTOMY BILAT. OOPHORECTOMY	PANHYSTERECTOMY UNILAT. OOPHORECTOMY	PANHYSTERECTOMY BOTH OVARIES RET.	VAGINAL HYSTERECTOMY	TOTAL
Number in 1922	1	5	8	10	17	2	1	1	0	45
Percentage for year	2	11	17	22	37	4	2	2		
Number in 1923	0	2	11	16	15	2	1	2	0	49
Percentage for year	0	4	22	32	30	4	2	4		
Number in 1924	4	12	9	10	30	3	1	4	2	75
Percentage for year	5	16	12	13	40	4	1	5	2	
Total number for 3 years	5	19	28	36	62	7	3	7	2	169
Percentage	2.9	11.2	16.5	21.3	36.5	4.1	1.7	4.1	1.1	

in a case of a ruptured suppurating ovarian cyst, operated upon as an emergency case, in which the associated fibroid tumor was a secondary consideration. It is included for the sake of completeness, though not properly belonging in a series of fibroids. If this case were excluded, as it should be, the mortality of our operative series of 266 cases would be 0.7 per cent, or two deaths, 1 from postoperative pneumonia and 1 from general peritonitis. If we apply these 2 deaths against the entire series of 422 cases treated either by operation or radium, we find that the mortality rate drops to 0.47 per cent, which properly represents our mortality for the treatment of uterine fibroids. If we include the ruptured suppurating ovarian cyst, the mortality of the entire series is 0.7 per cent.

TABLE IV

POSTOPERATIVE COMPLICATIONS

	1922	1923	1924	TOTAL	PER CENT OF SERIES
Number of operations	75	77	115	267	
Wound infection	2	7	5	14	5.2
Pelvic peritonitis	4	2	4	10	3.7
General peritonitis	1	0	1	2	0.7
Pulmonary embolism	1	1	3	5	1.8
Postoperative pneumonia	1	1	1	3	1.1
Phlebitis	0	2	0	2	0.7
Death	2	0	1	3	1.1

We have careful follow-up records on 56.1 per cent of the series. The end-results of operative cases as ascertained by follow-up examination have been satisfactory in 94.7 per cent of the cases followed. The unsatisfactory results, 8 in number, were in the following cases: 1, intraligamentary fibroid; 2, ruptured suppurating ovarian cyst;

TABLE V

MORTALITY

	NUMBER	DEATHS	% MORTALITY
Uncomplicated operations	169	0	0
Irradiations	155	0	0
Total of uncomplicated cases	324	0	0
Complicated operations	98	3	3
Grand total	422	3	0.7
Excluding ruptured suppurating ovarian cyst			0.47%

3, carcinoma of the ovary; 4, simple fibroid (pain continued—probably error in diagnosis); 5, carcinoma of cervix; 6, carcinoma of ovary; 7, resection of sigmoid; 8, pelvic inflammatory disease with residual abscess. Again it is seen that the unsatisfactory results usually occur in cases with important complicating pelvic disease. We have excluded extrapelvic complicating diseases, such as disease of the gall bladder, appendix, breast, etc., as not coming within the scope of this paper.

IRRADIATION CASES

Our analysis of the 153 cases in which radium was applied, simply confirms our previous opinions. Table VI shows that 84.3 per cent of the patients were over forty-one years of age. Menorrhagia was by far the most important symptom, with backache, metrorrhagia, and leucorrhea, much less frequently present. In only one case were pressure symptoms present. Of the 153 cases, in 98, only radium was applied; in 45, some plastic operation on the cervix or perineum was performed in addition to the radium application. In 8 other cases a vaginal myomectomy was performed before the radium was inserted,

TABLE VI

ANALYSIS OF IRRADIATION CASES

	1922	1923	1924	TOTAL
Total number	54	51	48	153
Under 30 years	1	1	0	2
31 to 35 years	1	1	2	4
36 to 40 years	5	5	8	18
Over 41 years	47	44	38	129
Per cent over 41	87	86	79	84.3
Menorrhagia	49	44	42	135
Metrorrhagia	11	10	7	28
Leucorrhea	10	9	4	23
Backache	15	9	8	32
Pressure symptoms	1	0	0	1
Radium only	35	31	32	98
Radium and plastic	17	16	12	45
Radium and vag. myomectomy	2	4	2	8
Radium and abdom. operation	0	0	2	2
Menses stopped	28	32	13	73
Menses continued	9	7	3	19
Required re-irradiation	1	1	1	3
Required hysterectomy	3	3	0	6

TABLE VII

RESULTS OF IRRADIATION

	1922	1923	1924	TOTAL
Total number	54	51	48	153
Number traced	37	39	16*	92
Cured	32	35	15	82
Per cent cured	86	89	93	89.1
Improved	1	1	0	2
Re-irradiation per cent				3.2
Hysterectomy per cent				6.5

*Many cases in this series too recent for follow-up.

while in 2 others there was an abdominal operation coincident with the radium application. Of 92 cases (60.1 per cent) traced, the menses stopped in 73, and continued in 19. Table VII shows that 82 patients (89.1 per cent) were cured, 2 were improved but not entirely relieved, 6 patients (6.5 per cent) required subsequent hysterectomy, 3 patients (3.2 per cent) required a second irradiation. The mortality in the series was nil. Table VIII shows the comparative figures in the two groups of cases. It should be explained that the 89.1 per cent cure for the irradiation cases means a cure was obtained from only one irradiation. Adding to this the 3.2 per cent which required reirradiation, we find that 92.3 per cent were cured by radium.

Two cases were subjected to x-ray therapy exclusively. One of these has been traced and has a satisfactory result. In 2 other cases, a sarcoma of the uterus and a carcinoma of the ovary, x-ray was used supplementary to operation.

TABLE VIII

COMPARATIVE ANALYSIS OF OPERATION AND IRRADIATION

	OPERATION	IRRADIATION
Total number	267	153
Number traced	150	92
Percentage traced	56.1	60.1
Number cured	142	82
Percentage cured	94.7	89.1
Mortality percentage	1.1	none

CONCLUSIONS

1. The treatment of uterine fibromyomata should be undertaken only by those who are thoroughly familiar with the operative as well as the irradiation method of treatment.

2. The mortality of radium irradiation in properly selected cases has been *nil* and satisfactory results will be obtained in about 90 per cent of the cases after one treatment.

3. The mortality of uncomplicated uterine fibroids subjected to operation is rapidly approaching the vanishing point, and is *nil* in this series.

4. The mortality in complicated cases subjected to operation is 3 per cent, but the mortality of our entire operative series varies from 0.7 per cent to 1.4 per cent, depending on cases included.

5. The mortality of the entire series of 422 cases, irradiated or operated upon, varies from 0.47 per cent to 0.7 per cent according to the method of calculation.

6. The end-results of operation are satisfactory in about 95 per cent of cases.

7. The mortality and morbidity of fibroid tumors of the uterus are usually due to complicating lesions.

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2017 Walnut Street. (*For discussion see page* 597.)

THE DEITIES CONCERNED WITH CHILDBIRTH AMONG ANCIENT PEOPLES*

By Edward A. Schumann, M.D., Philadelphia, Pa.

CHILDBIRTH among primitive peoples and in the ancient civilizations was held in the greatest reverence and women about to give birth were guarded against malign influences by deities of many and various powers, each of whom possessed some special sovereignty over the exigencies of human life. In many of the older peoples strikingly similar gods were worshipped even when the races involved were geographically far removed from one another and when no evidence remains of any interchange of cultural thought. Whether the peoples concerned independently developed identical mythology or whether there was a direct transmission or inheritance of the deities from one race to another is unknown, but the latter affords the more probable hypothesis.

History consists of a succession of overwhelmings of degenerate, highly developed societies by their more robust but less civilized neighbors, but while the governments and states of the weaker folk were subdued, their culture and institutions, being advanced so far beyond those of the dominant barbarians, were invariably absorbed and with more or less modification became a part of the civilization

*Read at a meeting of the Obstetrical Society of Philadelphia, February 5, 1925.

of the conqueror, his own established customs and rites being slowly submerged in great part. This explains the persistent similarity in basic religious ceremonies and in the personnel of deities among widely diversified peoples.

Exploration into the mazes of medical mythology is an illuminating pastime, well worth recommending and the identification of a widely known present-day obstetric superstition or folk practice as among the most impressive ceremonies of a long dead civilization, directs one's mind to the steady, unbroken march of human life and progress through the ages.

We learn of Astarte, the Istar of the Sumerians, who sailed majestically across the velvet Asian skies, the all Mother, the goddess of bearing, who wore as her symbol of fruitfulness the woman's girdle; of Mylitta, who had religious prostitutes under her protection and of a host of lesser divinities each with his or her special powers to be invoked on the fitting occasion.

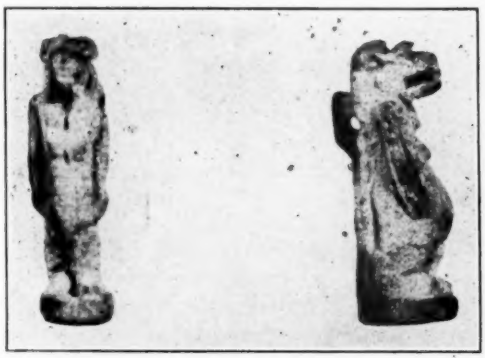

Fig. 1.—Egyptian amulet, goddess Thuseris from a tomb near Thebes.

As the ages passed, the same deification of fruitfulness was practiced by the numerous races until we find the Greeks worshipping the sea-born Aphrodite whom we call Venus.

Under whatever name and by what various rituals this deity was propitiated, the primordial principle was the same; the urge of mankind to worship the source of all fruitfulness and reproduction. From the Erda of the Norse Sagas to the Artemis of Rome, the symbol of this yearning worship was the maternal figure of a woman.

In Egypt, the science of theology was highly developed. The divinities were many in number and of accurately graded powers from the majestic moon goddess Isis, to those twilight divinities whose godhead clings very closely to the soil. Here was developed an extensive use of and faith in amulets, the little charms which kept a person from harm. Every Egyptian tomb yields a supply of these little figures, variously made of baked clay or laboriously cut from hard stones, some of them gems of craftmanship as well as of material.

The amulet was used as evidence that its living wearer claimed the especial protection of some god; and to insure his or her favorable reception among the shades after death had carried its owner to the gloomy hereafter of the Egyptian theology, the little image was bound round the neck of his embalmed form, where it remained until the quiet of the tomb was broken by the modern despoiler.

The amulet most widely utilized to protect women in childhood was that of the goddess Thuseris who, legend holds, gave birth to the great Osiris, the mother being then called Apet. Her special function was to protect against the complications of labor and to insure to her votary the birth of a male infant. This deity is found generally in the form of a small amulet, worn only by the mummies of young adult women, probably those who died in childbed.

The possession of one of these charms taken from a tomb in Thebes, where for fifty centuries it had rested against the shriveled bosom of one who may well have been a gracious and charming matron until

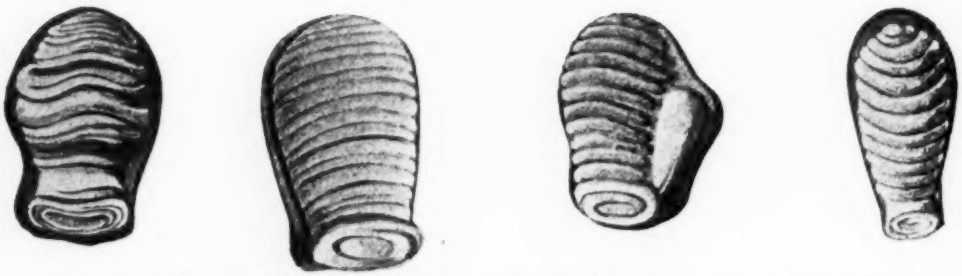

Fig. 2.—Votive offerings of terra cotta representing the uterus, one of them having an ovary attached. Rome, (after Curatola).

death cut her down at the moment of her life's fulfilment, is the inspiration of this paper. The figure is a small amulet, one and a half inches in height, made of a very hard baked clay which was originally white but has become stained and discolored by time. It represents a female seated, and having the head of a hippopotamus, long, slim, human arms, the legs short and squat, being those of the hippo. The goddess is represented as pregnant at term, the abdomen large and pendulous. There are four relaxed and pendulous breasts with well-defined nipples arranged in pairs. The image is seated on a stool with a high back, this latter pierced to receive the cord which bound the amulet round the neck of its wearer. (Fig. 1.)

Thuseris was a deity of great repute and the happy possessor of her statuette felt herself secure against whatever evils fate held in store for her.

Animals, which form so important a part of Egyptian mythology, were occasionally used as birth amulets. On some of the coffins of the Middle Kingdom were found paintings of objects made up of the

skins of foxes, some of them quite accurate consisting of the outer skin or skins attached by the mouth to a handle of leather or other material. These ornaments are represented by a hieroglyphic sign translated as ms or msy, meaning to give birth to. This belief is still extant in modern Egypt and Nubia, the skin of the fox hung over the door being supposed to protect against the danger of childbirth.

The Greeks, with their sensuous and delicate mythology, regarded amulets with much less respect, worshipping their divinities in groves and before altars which still remain as evidence to what heights in artistic endeavor the human mind and heart may achieve.

The more sturdy Romans adopted the Greek mythology in great measure, the chief deity swaying the destinies of pregnant women being the Diana of the Greeks, variously invoked as Artemis, or more

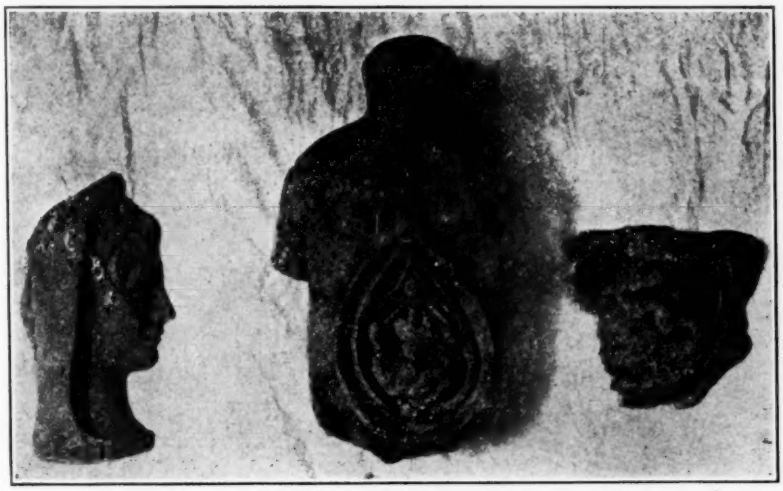

Fig. 3.—Votive offerings, Rome. The head of a goddess, abdomen showing fetus *in situ*, and an umbilical cord. (After Curatola.)

commonly Lucina, whose altars rise on the Italian hills and to whom the women of Rome brought their supplications for a safe deliverance.

While Lucina was the most powerful divinity to shield the Roman parturient woman, there were lesser deities whose aid was usually invoked, the three Dii Nixi, as witness Ovid:

"Lucinam, Nixosque pari clamore vocabant." (Ovid, Metamorphosis, lix, U-294). These Dii Nixi were brought to Rome as goddesses of the lesser sort by the Consul Ocilius, after the overthrow of the Emperor Antiochus of Syria, and before they could be summoned the votary must first purify himself by hand washing and covering the head.

Siebold holds that the Dii Nixi, always described and depicted as kneeling figures, were also involved in Greek mythology, citing as an instance the accounts of the birth of Apollo, whose mother Latona is

represented as delivering herself in a kneeling posture, holding a palm branch in her hands.

It has already been stated that the powerful deities who sponsored childbirth in ancient Rome, had been inherited from the Greek culture and were worshipped in Rome simply under different names, although in some instances the Grecian nomenclature was retained in its entirety. It has been shown earlier in this discussion that the Greeks themselves acquired many of their gods from the Egyptians, who in turn were indebted to the Sumerians and Chaldeans for a large part of their mythology, the whole process being one of assimilation of acceptable religious cults and ceremonies by a younger people from those older civilizations which they overwhelmed by force of arms

Fig. 4.—Votive offering. Rome. A fetus in the uterus. (After Curatola.)

or absorbed by their more vigorous development. Thus we find the worship of Illitia, Hera or Artemis instead of Lucina. The goddess is, however, generally styled Juno Lucina and is represented as wearing a matron's toga, with a spear in the right hand and a shell to receive offerings in the left, or with the torch upraised for the guidance of the newborn, as she is so beautifully drawn in Rubens' "Birth of Marie de Medici." The crown of ash leaves, the plant so important in obstetric mythology, is usually prominently displayed.

The most important temple of Lucina or Diana was at Nemi by the little woodland lake of that name and to this place came the women to supplicate the divinity that they might be insured a happy termination of their labor and to bring votive offerings and coins. More than a thousand medals and coins were unearthed at this temple

upon its excavation by Lord Savile in 1885, together with many statuettes of terra cotta and bronze. In cases of difficult labor the goddess was called seven times and upon the successful outcome, gifts of silver were offered to the temple, or a young sheep, sometimes a

Fig. 5.—Votive coins and medals to Lucina and Diana. Rome.

snow white heifer was sacrificed. Many of the medals of Lucina have been preserved, some of them being very beautiful.

In one of these medallions Lucina is represented as bearing a whip of thongs of goat skin, the lash being a symbol of recovery from childbirth, a reminiscence of the feast of Lupercalia during which, in the very early days of the republic, adolescents ran through the streets of Rome lightly striking the abdomens of pregnant women

with these goat skin whips to frighten away the evil genii of difficult labor. What a curious beginning to our elaborate system of prenatal care!

The use of votive offerings and amulets is of very ancient origin, and reached a great height in Rome. Here these offerings took the form of medals and of little models in terra cotta and bronze. A commonly used figure was that of the uterus in the pregnant and nonpregnant states, its muscle fibers showing very well, and the ovary occasionally represented in fairly accurate reproduction. Others show congenital malformations and some which represent the entire pregnant abdomen with the fetus *in situ* have been unearthed. (Figs. 3, 4.)

The exact purpose of these Roman votive offerings has occasioned considerable dispute but the generally credited view is that they all are evidences of a sort of contract between the pregnant woman and her especial divinity, concerning the outcome of her delivery, and upon the goddess performing her part of the bargain, the patient paid for the service rendered by these little reproductions of her organs which had by divine aid been restored to health.

With the downfall of Rome, and the birth and spread of the two great modern religions, Christianity and Mohammedanism, the vogue of the lesser pagan gods slowly and steadily declined, their votaries became scattered and few, until today the figures which filled the spiritual world of men and women and controlled the wellsprings of human devotion have been reduced to curious antiquities upon which one may pass an idle moment in speculation and retrospect.

Times change and customs differ, but the essentials of human nature remain unaltered. With the development of science and the decline of the belief in personal and household deities, the expectant mother has changed her practice in securing protection against the perils of childbed but not her principles.

When the Egyptian woman of the fourth dynasty, sought the priest in "many templed Thebes" and from him secured a little baked clay image of the ill-favored divinity Thuseris, she prayerfully bound it round her neck and faced her travail secure in the knowledge that she would safely pass through the valley of the shadow and emerge triumphant with her man-child at her breast.

Today the woman of twentieth century America, finding herself gravid, arranges for a south-windowed room in the hospital of her choice, selects her accoucheur with due regard to her predilection for twilight sleep, prophylactic forceps or Potter version, and marches blithely through her time serene and confident in the outcome, even as was her sister 5000 years ago. Does her faith rest on a more secure foundation? I hope so.

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1814 Spruce Street.

Department of Maternal Welfare

CONDUCTED BY FRED L. ADAIR, M.D.

THE Department of Maternal Welfare of the Journal is not yet old enough to celebrate one anniversary, to say nothing of commemorating its fifth. It may perhaps be appropriate to mention that beginning with this number this department will be conducted under the auspices of the Joint Committee of Maternal Welfare, through the chairman of that body. It is fitting to thank the editors of the Journal for their vision in establishing this department of the Journal and to express appreciation of their kindness in desiring the cooperation and help of the Joint Committee in building up this part of their publication.

Health is no longer a problem of the individual alone; it is also one of the community no matter whether it be large or small. This has long been recognized with reference to the contagious and communicable diseases. More recently it has been considered that the attainment of health by prevention is a still larger problem than indicated above, and that many other questions of health must be regarded not as problems involving only the individual himself, or solely the relationship between the physician and patient. This provision for the health of its members is an economical, social, and medical problem of the community. One might regard this healthy, normal individual as a credit or asset, but the unhealthy, abnormal member as a debit or liability to society. Many thinkers and workers who are engaged in the application and the solution of these health measures for the community seem to feel that the municipality and state should make it their business to see that the individual members of society have good health. They believe this should be accomplished in a manner similar to that by which the state attempts to see that its constituents receive the necessary education. In furnishing education the cost of certain minimums is spread by means of taxation, and the individual is obliged in many places to receive this training without personal monetary cost. The state further supplies to its members opportunity for more complete development, for which they must individually pay part of the cost.

The same plan holds true to a more limited extent regarding the health measures of society, but the minimum requirements are not so clearly defined, and are being constantly extended. This has led to a discussion and struggle about so-called Social or State Medicine, which is, of course, nothing more or less than the taking over by society of a greater or lesser part of the functions of private physicians as exercised in times past and

present and, what is of vastly greater importance, has led to the establishment and conduct of new spheres of health activities. These new spheres, which might be designated "Preventive Medicine," have never been occupied to any extent by the private practitioner. One of these fields is that which has developed recently and passes under the name of Maternal Welfare.

Childbearing has long been regarded as a normal and relatively harmless process and, unless given special thought and attention, the fact that the normal processes often become abnormal escapes casual observation. When the too frequent tragedies affecting mother and offspring occurred they were apt to be dismissed as unfortunate but unavoidable accidents. For many years greater or lesser effort has been sporadically and spasmodically expended in improving intrapartum and natal care, but on account of the great routine physical and other effort required of the attendants, much of the best trained talent has drifted into other fields of medical and surgical practice. It is possible also that other less arduous but more lucrative fields have proved more enticing.

In this country, as well as in other parts of the world, the care of mothers and infants at and immediately after birth falls far short of even our present ideas of what constitutes good obstetric practice. Unsatisfactory as the care received at the time of confinement remains, there has been and still is a much bigger gap in the essential attention given to prospective mothers and offspring.

This part of maternal care has as its purpose the careful attention of the mother during pregnancy with the idea of conserving the happiness, health, and life of both mother and offspring. This is what we now call prenatal or antenatal care. It is only within relatively recent years that any material progress has been made in developing and carrying out this program, which is really the practice of preventive medicine as applied to maternity. It is readily seen how closely this field of work should articulate with that earlier cultivated field of natal care.

There is also the vastly important work of postnatal care, which includes the immediate care given to mother and offspring during what may be called the lying-in period. This should be followed by appropriate care of early infancy and subsequent infant life, the standards of which have been quite well worked out. It is apart from our purpose, even if it were necessary, to argue the importance to subsequent life of such care of the offspring. We are more particularly concerned with what may be appropriately termed postpartum care, which implies the attention which should be given to mothers immediately after the birth of the child. Postpartum care starts when the lying-in period begins. It should be continued over a time as yet undetermined. When this care should end no one can at the present time with any authority state.

Here is a new field without any accepted and authoritative standards and one which may mean much to the future health and life of the

mother, the family, and the community. It was thoughts such as these which have led to the development of programs of prenatal, improved natal, and beginnings of postnatal care, all of which fields are comprised in that of Maternal Welfare. It was similar ideas which led to the formation of the Joint Committee of Maternal Welfare with the added hope that physicians through their special societies might take and hold the lead in developing that phase of preventive medicine which applies to maternity and early infancy.

We wish to call the attention of the readers to the purpose of our Committee on Maternal Welfare, the personnel of which is appointed by the American Gynecological Society, the American Association of Obstetricians and Gynecologists, and the American Child Welfare Society. It devotes its attention to problems of the health and lives of mothers and their offspring, and those of women in general. The main object of the Committee has been to reach those of the profession who deal with mothers and young infants, and to call attention of practitioners to the great importance of an opportunity for rendering better service to those members of the community who too often sacrifice their health and lives that the race may be perpetuated.

It might tersely be said that the "communities should be made safe for maternity." The fundamentals of this plan are that the laity should seek and the profession give services which are commensurate with the importance of childbearing.

Our Committee is especially interested in the problem of having mothers, who seek such care, receive it. How can the health and lives of mothers best be conserved? The answer is furnished by an analysis of the causes of maternal morbidity and mortality. It is, of course, well known that injuries, infections, and toxemias are the great factors in causing these untoward results for the mothers. Maternal injuries may be both prevented and properly repaired so that there may be a minimum of disability and fatality. This can best be accomplished by a proper antepartum study of the case, with proper preparation for the intrapartum care which is of paramount importance in this phase of the work.

Infections, puerperal in nature, take far too great a toll and prevention is the only means of reducing the morbidity and mortality. The treatment of an infection which has occurred is at best frequently disappointing and often results in an incomplete restoration to the normal status. Infections can be prevented in most instances by proper antepartum study and advice, with selection and classification of the patients so that they may receive proper home or institutional, general or expert care, as the need may be.

Infection with gonorrhea should be detected prior to, or during pregnancy, and treatment instituted to remedy this condition as completely as possible before labor gives the opportunity for an extension to puerperal infection. Other obvious genital infections of less serious character should, if possible, be cleared up before the onset of labor.

The other great factor in the production, both directly and indirectly, of maternal mortality and morbidity is toxemia. Unfortunately we are much in the dark regarding this condition, and at present our only hope of securing good results is in the early detection of this disease rather than in methods of prevention. This requires careful, frequent, routine observations and the institution of remedial measures before the condition has assumed serious proportions. Accidents of pregnancy and labor, while of great importance, are naturally not so amenable to preventive measures.

Practically the same groups of causes operate to cause fetal morbidity and mortality, birth injuries, infections, including venereal diseases, and toxemias. These detrimental results can be obviated in many instances by necessary and appropriate attention during the prenatal, natal, and postnatal cycles of the fetal and infant life.

The Joint Committee feels that great good can be accomplished for both the medical profession and the community by the proper study of, and attention to, these big problems which steadily assume greater importance with the increasing value of normal human lives in the community. The Committee, therefore, welcomes the opportunity of reaching medical men through the Department of Maternal Welfare, and the column will be devoted to keeping the readers in touch with work which is being done along these lines in different parts of the country.

This department is of too recent origin to need a review of the articles which have appeared under its captions, and yet it is necessary to continuously and repeatedly stress the importance of this activity. It brings out some new points of view which are a little out of the usual line of thought of the medical mind and reiteration is necessary in order to direct the mind into these new channels of thought. It may not be amiss to quote from the announcement made in the first number in which this department appeared (Journal, 1925, ix, 268): "That maternal morbidity and mortality from childbearing is undoubtedly high in this country, cannot be entirely denied, likewise that there is a deplorable loss of fetal life from abortions, premature labors, and the accidents associated with childbirth. The correction of these problems must be approached from more than one angle. It cannot be solved except by a combination of forces, and the direction of these forces should rest in the medical profession itself,—which means better teaching of obstetrics, the continued attention of the practitioner to obstetric progress, the inclusion of more obstetric topics in the programs of our general medical societies and the education of the public to demand and to be willing to pay for better attention during pregnancy and labor. In all of this the medical man should be the guiding force and spirit, although lay participation is greatly to be desired and hoped for."

—Fred L. Adair, M.D.

Society Transactions

THE AMERICAN GYNECOLOGICAL SOCIETY

FIFTIETH ANNUAL MEETING

WASHINGTON, D. C., MAY 4, 5, AND 6, 1925

(Continued from September)

DR. JOSEPH B. DELEE, Chicago, Ill., presented a series of lantern slides, illustrating the **History of the Low or Cervical Cesarean Section, Including Laparotrachelotomy.** (For original article see page 503.)

DISCUSSION

DR. ALFRED C. BECK, BROOKLYN, N. Y.—I want to tell Dr. DeLee that this is not the Beck operation. I looked up the Opitz reference and I found that what I described as a modification of the Krönig technic was described by Opitz in 1911 and 1914. I wish, therefore, to acknowledge his priority. What I did was a very simple thing and possibly should not be spoken of so highly in connection with my name. The literature before the time of Frank is quite unknown to me. Dr. Dewees, however, apparently thought very little of the suggestion of Physick of Philadelphia, because in most of the latter editions of his work he omitted the footnote in which Dr. Physick's suggestion was mentioned. I think the greatest credit possibly in connection with the low cesarean section belongs to Frank because he again directed attention to the lower segment and better peritonealization of the wound.

I think that, instead of looking upon the subject in a chronologic way, we may better understand its history if we divide the men who have worked along this line into two groups. The first group includes those who were very much afraid of the amniotic spill and attempted to do an extraperitoneal operation. The second group feared the spill less and did the procedure by a transperitoneal technic which led to a more perfect peritonealization of the wound in the lower segment.

Frank, in his first operation, did exactly what Physick suggested. He found, however that in some instances it was impossible to peel the peritoneum off the bladder and consequently recommended that the transperitoneal route be followed. Sellheim immediately modified Frank's idea as Dr. DeLee has shown us. Veit, Fromme, and Hirst devised the technic which is known in this country as the Hirst operation. Latzko, however, clung to the original extraperitoneal idea and gave us the technic which is now followed by the adherents of the first group. All of these men in the first group who were so fearful of the spill, did broad dissections in the cellular tissue and apparently were less fearful of infection in this region than they were of infection of the peritoneal cavity from the spill.

The second group, those who cared less about the spill, approached the lower segment through the peritoneal cavity and relied upon the measures usually employed in abdominal surgery to protect the peritoneum from contamination. They depended more upon the extraperitoneal closure to protect the peritoneal cavity from infection should an infected uterine wound break down. The chief mem-

bers of this group are Krönig, whose operation is known to all of us, and Opitz whose technic is essentially that described by Dr. DeLee and myself.

Dr. DeLee omitted Doederlein in his discussion, whose name is frequently mentioned in connection with the low operation. He independently did the Latzko procedure but later acknowledged Latzko's priority.

DR. GEORGE W. KOSMAK, NEW YORK CITY.—One statement made by Dr. DeLee is of special interest, namely, that one of the indications for low cesarean section is the observation made by an earlier operator, that rupture of the uterus in the lower uterine segment is much less dangerous than in the upper segment. I think that statement should be accepted with some question. In my own experience I know that the cases of rupture of the uterus that took place during labor were much more dangerous when the rupture took place in the lower uterine segment and involved in that region the larger vessels. I have seen cases where the rupture took place in the upper segment, with practically no shock to the patient.

DR. DELEE (closing).—Regarding Opitz, I would say that I consulted his original paper and found he is not entitled to the credit for that operation. The development of this part of the operation was done at the Chicago Lying-in Hospital but I thought the credit should be given to Dr. Beck because he first published and emphasized it. Opitz cut the peritoneum at the edge of the bladder and did not overlap in suturing. The overlapping of the two flaps, we developed at the Lying-in Hospital. We fell into it naturally, by our mistakes. We found if the incision in the peritoneum was made too low, we did not have enough room and we made an upper flap too, but we have given up overlapping except in infected cases because when we do a second and third operation on clean cases we found we had used up the peritoneum of the anterior culdesac.

Doederlein is mentioned in my paper. The distinction between those that are afraid of the primary spill and those that feared the lochia is also made in the paper. We divide them into the extra—and intraperitonealists and war was waged among the Germans, who are great believers in this operation, as to which method is better. The favor seems to be on the side of the intraperitonealists, although Küstner and Doederlein stick to the old extraperitoneal operation.

The indications for this low operation are restricted and limited. Whereas at first we regarded it with great enthusiasm, thinking that at last we could get rid of the craniotomies on living children, still it did not eliminate all the dangers of peritonitis.

As to Dr. Kosmak's point that a rupture in the upper part of the uterus is not more dangerous than in the lower,—that depends on the time of occurrence. In the olden times a rupture in the upper part of the uterus was always fatal because the belly had to be opened and that was necessarily fatal. If it occurred in the lower part of the uterus craniotomy could be done and still the baby could be got out below. In those days a fundal rupture was feared most. Nowadays we fear them also because they occur during pregnancy when the woman is far from help.

DR. JOHN O. POLAK, Brooklyn, N. Y., presented a paper entitled, **Further Studies in Puerperal Infections and Their Treatment.** (For original article see page 521.)

DISCUSSION

DR. CLARENCE B. INGRAHAM, DENVER, COLO.—Blood transfusion in puerperal infection is promising on *a priori* grounds, not so much from the addition

of red blood cells and increase of hemaglobin, but from the leucocytes with their phagocytic action, and from the addition of protective substance in the donor's blood. Yet we do not know that leucocytes so introduced still maintain their phagocytic action or that we are actually introducing protective substances or whether they are formed afterwards. These are questions which naturally arise when rationalizing on blood transfusion therapy.

The addition of Ringer's solution, which has the same osmotic pressure and the same hydrogen-ion content as blood, would seem a valuable method of furnishing the fluid which we recognize as being so necessary in combating any infection.

As regards the intravenous injection of chemicals, especially mercurochrome, there have been so many favorable reports of cures in desperate cases by other trustworthy sources, that I would feel this is still a debatable question. Personally, I have at times been enthusiastic because I have felt that I have obtained results, but more often have I felt thoroughly disappointed.

Though the spontaneous cure of puerperal infection is by the natural process of immunization, it does not follow that chemicals are not of value. It has been stated elsewhere that rapid destruction of bacteria from the introduction of mercurochrome suddenly throws into the blood stream a large quantity of their protein and causes an immunization in this way.

While it is stated by those who do not believe in this treatment, that weak solutions of any antiseptic may inhibit the growth of bacteria on artificial media and that when introduced into the blood stream often have so much more affinity for other constituents of the blood tissue than for bacteria, that they are either of no value, or may even be harmful, yet in a dilution of 1-16,000 (above what occurs in ordinary doses) hemolytic streptococci which have been added to blood, are killed within one hour.

Dr. Polak has spoken of the harmful effects of mercurochrome on the kidneys, heart muscle, and other organs. There is no doubt that in sufficient dosage these bad effects are procured and definite cases of mercurial poisoning are reported, but if the proper dose is administered there is little evidence of actual damage other than a transitory cloudy swelling of the kidneys.

The fact that the blood may be rendered sterile, and this is accomplished in certain instances as shown by positive blood cultures becoming negative after injection, is evidence of the value of chemical injection and it should be given a trial in desperate cases.

DR. EDWARD A. SCHUMANN, PHILADELPHIA, PA.—The statement is made "that the patient recovers by producing an immunity against the infecting bacteria with her cellular structures and body fluids." This is perfectly true, of course, but to use a mathematical simile it is expressing but one of two simultaneous equations or one side of a compound equation, since it is equally true that the patient may recover without any increase in her resistive forces, provided the infective bacteria be removed or rendered inactive.

These opposing principles are commonly noted in cases of localized collection of pus, as for example appendicular abscess, when recovery may take place without evacuation of the pus by the development of such powerful antibodies that the virulence of the invading organisms is overcome, and the products of suppuration are slowly resorbed. On the other hand, surgical interference and drainage will accomplish the same happy result usually with much more definiteness by removing the bacteria laden pus, even though the resistance of the patient be not increased.

The same general mechanism holds true in blood-stream infections.

With regard to the untoward degenerative changes produced by the various

chemicals as mercurochrome, etc., I feel that if it be true that these dyes do destroy bacteria circulating in the blood stream, a certain amount of tissue destruction occurring in association with such blood-stream sterilization will be more than compensated for by the removal of the infective agents.

We in Philadelphia, are, of course, more familiar with mercurochrome than with the other dyes, since Piper's original work has been done among us, and while I do not wish to anticipate the consideration of this drug which forms a part of the program of this meeting, it may be said that from a clinical standpoint it is the most satisfactory agent for blood sterilization that has come to my notice, although far from ideal.

Blood transfusions are of great value, although here again an occasional calamity, profound reaction, hemolysis and a rapidly fatal termination follow transfusions even when the donor's blood conforms to all the requirements as to type. I have twice seen this accident take place, once in a true puerperal sepsis and once in an infected abortion. In general, however, blood transfusion is a measure of the greatest value.

Dr. Polak's conclusion that, transfusions to reach their greatest efficacy should be performed early in the disease is absolutely correct, but here again, conditions and theories are widely divergent.

Cases of puerperal sepsis rarely come under the observation of the specialist until the infection is widespread and the patient in deadly peril of her life. A more diffused knowledge as to the simplicity of blood transfusion and its immense therapeutic value in these cases may eventually lead to its earlier employment in the hands of physicians at large.

DR. J. HOFBAUER, BALTIMORE, MD.—I desire to present a preliminary report of investigations carried out in the Obstetrical Department of the Johns Hopkins Hospital to determine whether there is some defensive mechanism in the base of the broad ligament capable of preventing puerperal infection. If we realize the condition of this region after childbirth it is apparent that there are many factors which favor its infection: the softening of the tissues, the enlargement of the connective tissue spaces, the bruising of the parts. To these must be added the occurrence of slight or deeper lacerations of the cervical tissue as actively absorptive areas, through which bacteria gain entrance to the subadjacent parts and travel into the lymphatic spaces. It has come to be the accepted opinion that the vagina and the cervix, in a large percentage of cases in the last weeks of pregnancy, contain many bacteria, even the streptococcus, and that given favorable conditions, these bacteria, while usually living a saprophytic existence, could become virulent. The question why under these circumstances every woman does not become infected, has been answered in many ways. But no satisfactory explanation could be adduced. The idea has been advanced by DeLee that possibly some immunizing forces are here at work to produce local cell immunity.

With this concept in mind we studied the conditions of the base of the broad ligament during pregnancy, labor and after labor, since the lymphatics passing through the cervix unite on the edge of the uterine wall and run along the uterine artery.

On account of lack of time I can give only the results of our investigations. Thirty-five specimens from various months of pregnancy have been at my disposal. In the great majority the uterus had been removed during labor on account of ascending infection or at the end of pregnancy to sterilize the patient following a third cesarean section.

The examination of the base of the broad ligament revealed the interesting fact that at the end of pregnancy there is a conspicuous appearance of macro-

phages following the course of the uterine vessels. This type of cell is also present in the connective tissue spaces in the outer layers of the cervix at the level of the internal os. The principal feature to be noted at the end of labor is that there are throngs of macrophages, in other words that there is a marked local increase of the above-mentioned cells under the stress of labor. These cells exhibit a high phagocytic power; they are capable of engulfing red blood cells and débris and of transforming hemoglobin into hematin; they take up neutral red with avidity. These monocytes and clasmatocytes can be traced to a definite type of cells which are located close to the small vessels of the parametrium and retain the properties of embryonic mesenchyme in multiplying very rapidly by mitosis and furnishing throngs of macrophages.

In general, clasmatocytes are recognized as appearing particularly in localized infections, in which an active resistance is being manifested. The work of Gay and others emphasizes the importance of these cells for the disposal of acute infection and indicates that local immunity may depend on the presence or mobilization of clasmatocytes. The variations in resistance in different areas of the body to streptococcus are associated with the relative numbers of clasmatocytes actually present or accessible in such areas.

The findings we have submitted seem to explain how the parametrium reacts to produce, to some extent, a local immunity against infection during labor.

DR. GEORGE W. KOSMAK, NEW YORK CITY.—I would like to call attention to one point in the technic of transfusions. Dr. Polak's warning is a very valuable one because the indiscriminate use of these very powerful dyes will do a great deal of harm in the hands of one who is not a careful observer and does not know how to use them. On the other hand, many persons are thoroughly familiar with the technic of blood transfusions and these methods may be employed without danger. I have always found that the employment of small amounts of blood repeated at frequent intervals is preferable to larger quantities. With the various apparatuses that have now been perfected for this purpose it is a simple matter to do this and there is no difficulty in finding technicians to apply it.

Another point: where repeated transfusions are indicated, it has seemed to me advisable to employ a new donor each time, especially where reaction has occurred after the first transfusion. In one particular case of septic abortion, in which the streptococcus was found in the blood, I used five or six members of this woman's family. She had a chill at the first transfusion. I gave 600 c.c. of the blood, and afterwards gave much smaller quantities and got no reaction. I think smaller quantities should be used if a different donor is employed each time.

DR. POLAK (closing).—The point that I wanted to bring out was this: that there are many patients who die from infection. Some of them nothing in the world can save. There are, however, a large number of infections, severe ones, that show by repeated culture no bacteria in the blood. Now, there is no one in this audience who will throw mercurochrome or acriflavine into the blood if the blood culture is negative and yet we can save those patients if we will start early enough by giving blood transfusions.

Dr. Kosmak's point is included in my paper. We gave 200 c.c., 250 and sometimes 500 c.c. To add to it Ringer's solution is the better way so far as the chemistry is concerned. These patients show a definite improvement.

The other point to which I want to call attention, is the fact that the blood of these patients has to be typed, matched and rematched, and the rematching should be done immediately before the transfusion, not two or three hours before, because something in the blood stream may change in that interval.

Finally, we have not been afraid to use mercurochrome; since Dr. Piper brought it out we have used it consistently. In Brooklyn we have not had such good results as have been obtained in Philadelphia. We have followed Dr. Piper's technic exactly and have found that we could clear the blood for perhaps twenty-four hours of any definite culture of bacteria, but the bacteria and the colonies were increased at the end of that time with the use of mercurochrome.

DR. CAREY CULBERTSON, Chicago, presented a paper entitled, **Hematoma Occurring Spontaneously in the Sheath of the Rectus Abdominis Muscle. A Consideration of Its Gynecological and Obstetrical Significance, with the Report of Two Cases,** of which the following is the author's abstract:

Hematoma in the sheath of the abdominal rectus muscle, occurring spontaneously, forms a condition given little or no attention in the textbooks, yet a sufficiently large number of cases have appeared in the literature to place this condition in the light of a clinical entity. It has occurred as a complication of influenza, typhoid fever, and other infectious diseases, as the result of muscular effort, in elderly women, and during pregnancy and labor. The hematoma develops as the result of laceration of the fibers of the muscle, with injury to one of the deep epigastric vessels or its branches, and varies in size according to the amount of blood escaping. It is nearly always unilateral and below the umbilicus.

A chief characteristic is the occurrence of pain, with or without previous muscular effort, increasing with continued activity until the patient is forced to go to bed. A second characteristic is the suggestion of peritonitis with the result that error in diagnosis is usual. Irritation of the external surface of the peritoneum produces a reaction much like that of intraperitoneal disease. The pain and general reaction resulting from rectus sheath hematoma suggests a more serious situation than actually exists. In women, in whom the broad ligament may be involved, operation is usually undertaken for some acute intraabdominal pathologic condition.

The author has collected from the literature twelve cases of rectus hematoma occurring in women who were pregnant, and twenty-seven cases occurring in the nonpregnant. To this latter group he adds one of his own and one through the courtesy of Dr. Carl Beck.

The author's case is that of a patient, the mother of two children, who, while playing golf, experienced a sudden, sharp pain in the lower right abdomen which forced her to discontinue the game. Five days later, during a second game she was again forced to stop, the pain becoming so severe that she went to bed. She was sent to the hospital and operated upon a few days later for probable ectopic pregnancy, there being a mass in the right pelvis. This proved to be a rectus hematoma extending down into the broad ligament, with partial rupture of the rectus muscle.

Beck's case is that of an obese multipara suffering from severe bronchitis. After several days of hard coughing she experienced pain in the upper right abdomen where a tender swelling had developed. She was operated upon under the diagnosis of gall bladder disease but the condition, again, proved to be a hematoma in the rectus sheath just beneath the free edge of the ribs.

Summary.—Twenty-nine patients were not pregnant, twelve were pregnant or recently delivered when the rupture was discovered.

Of the twenty-nine who were not pregnant, thirteen were over fifty years of age, seven between forty and fifty and six under forty, the ages of three not being stated.

Coughing due to bronchitis or influenza was given as the immediate cause in eleven cases, ordinary bodily movements in five and unusual muscular exertion in six. No apparent cause was seen in three cases. Vomiting preceded the rupture in one patient and in but one was participation in athletic exercise the factor.

Arteriosclerosis was a known condition in one patient, heart disease had been present in two and hemiplegia had occurred previously in one other.

Obesity was emphasized in nine of the reports, but in nineteen this feature is not mentioned. One patient was not obese.

Fifteen of the patients had had children, most of them several. In thirteen reports parity is not mentioned; in but one was the patient a nullipara.

Diagnostic error is an outstanding feature in these reports. In six cases the diagnosis was that of appendicitis, in seven, ovarian cyst with twisted pedicle, in two, appendicitis or ovarian cyst, in two, ovarian tumor, in two, gall bladder disease. In three cases the preoperative diagnosis was not stated. In one case each the condition was thought to be mesenteric embolism, intraperitoneal disease, intestinal obstruction, abdominal hernia, dermoid tumor, and ectopic pregnancy. In three cases rectus hematoma was diagnosed and in two others it was suspected.

The treatment is conservative if the hematoma is small; if large enough to require evacuation, if infected, or if it has ruptured internally, operative interference is indicated.

DISCUSSION

DR. JAMES E. KING, BUFFALO, N. Y.—It seems to me, from one experience that I have had during the past winter, that perhaps Dr. Culbertson is correct in feeling that there should be a definite clinical place given to these cases of hemorrhage into the abdominal wall.

My patient was aged 49, married, with eight living children, all delivered normally. She had been in the menopause one year, no history of pelvic, intestinal or other abnormality. She was admitted to the hospital about eight days after the onset of her trouble. Five or six days previous to the onset she described a condition which her physician diagnosed as grippe. Eight days before her admission she was seized with a sudden sharp pain in her right side, accompanied by some vomiting. Her family physician who was called found a temperature of 103°, pulse 100 and marked tenderness in right lower quadrant on pressure, with continuous pain. He did not at that time discover any mass. Twelve hours later, there was still considerable pain and a mass was found on the right side which was very tender to pressure. Patient remained in bed seven days, her physician being uncertain about the diagnosis, but finally thinking that he was dealing with some rather obscure appendix condition, he brought her into the hospital.

On admission her leucocyte count was 9900 and she presented a tender mass in the right lower quadrant. The question of an appendix with overlapped omentum, adherent to the abdominal wall, was considered, and also the possibility of an omental hernia. An exploratory operation was done and after having gone through the external oblique fascia a large clot the size of a good-sized lemon was found. This was enucleated. I was unable to find the source of the bleeding. A small drain was inserted and the patient made an uneventful recovery. Because of her temperature at the onset, and the fact that she had had a condition which was diagnosed as grippe just previous to the onset, brings up the question of an etiological relationship.

DR. JOSEPH B. DE LEE, CHICAGO, ILL.—I wish to call attention to one form of hematoma in the rectus muscle, or rather behind the rectus, which is not so uncommon as Dr. Culbertson has indicated, but which can occur after ordinary laparotomy. I use in my gynecological work, as well as obstetrical, the old "trap-door" incision

where the rectus muscle is pulled out of its sheath and afterwards replaced. A relatively large branch of the deep epigastric artery ascends the posterior sheath of the rectus and enters the muscle about half way between its outer and inner border. The vessel is often rupturd by traction, causing a hematoma. I had one such case. On the second day the patient began to vomit, had a temperature of 102° and all the signs of a beginning peritonitis. I found a hematoma behind the rectus muscle which made a distinct prominence in the peritoneal cavity, putting the peritoneum on the stretch and giving all the clinical signs of a peritonitis. We could not find the origin of the hemorrhage at that time because the muscle was infiltrated with blood but the main part of the blood was probably from the main branch of the deep epigastric artery.

Influenza or some other disturbance of general health may explain some of the hemorrhages and some of the failures in operation.

DR. BERNHARD FRIEDLAENDER, DETROIT, MICH.—Hematoma in the sheath of the abdominal rectus muscle occurs more frequently than is commonly supposed, and so we make it a rule in all our gynecological cases to make a thorough examination of this muscle. We have found three cases in the last three years. One was an infected hematoma. The other two were not infected and were due to rupture of the epigastric artery. In the infected case it was impossible to determine which one of the blood vessels was ruptured before it became infected. The third case was rather interesting. A woman, 59 years of age, had been suffering for several years, from a tumor in the left lower quadrant. Last spring, following an attack of influenza and cough, the tumor enlarged very rapidly, becoming the size of a small cocoanut in a short time. It was diagnosed by an internist as an ovarian cyst with a twisted pedicle, and a surgeon even went so far as to diagnose it as a sarcoma or carcinoma of the sigmoid. The examination of the enteric tract and the reproductive organs revealed nothing abnormal, and the tumor was confined strictly to the abdominal wall. We designate all such cases as abdominal apoplexies, and I would recommend that this term nomenclature be adopted to indicate this condition.

DR. HERBERT R. SPENCER, LONDON, ENGLAND.—I should like to call attention to three cases of hematoma of the abdominal wall, published by Dr. Russell Andrews in the *Proceedings of the Royal Society of Medicine.* (Vol. IX, 1916, Obs. & Gyn. Sec. p. 98.)

DR. CLARENCE B. INGRAHAM, DENVER, COLO.—I believe that there were many cases of hemorrhage in the rectus muscle occurring during the influenza epidemic in the army. Dr. J. N. Hall of Denver, a consultant, visiting the different camps, told me that he encountered several such cases following instances where there had been severe coughing.

I, personally, had occasion to open the muscle in one such case, there being present a considerable mass at the lower end of the left rectus muscle. A large hematoma was encountered, this I attributed to the tearing of the muscle and hemorrhage from a small vessel, though it is possible this bleeding may have arisen from the rupture of a larger vessel, such as the epigastric.

DR. CULBERTSON (closing).—The suggestion of abdominal apoplexy is a new one. Most of these cases appear in the literature as hematoma of the sheath or rupture of the rectus muscle or rupture of the deep epigastric. That was the reason it took me a long time to find Schumann's cases. I believe that hematoma is the best title for these spontaneous cases.

Regarding the war epidemic cases, I know of no literature coming out in the American Army which shows any of these cases due to influenza. The characteristic thing in most of the diagnoses seems to be the fact that the history which the

patient gives is ignored because patients so frequently ascribe intraperitoneal, intraabdominal conditions, peritonitis even or pus tubes, to something that they have done physically. My own case was that of a woman who was playing golf. She had sustained pain in her side and five days later had a severe hemorrhage. She had had a twenty-five mile automobile ride although she felt before starting that she was sick enough to call a doctor.

The treatment I did not mention. It consists, of course, in making the diagnosis and leaving alone the small hematomata because they may disappear in the course of time, and those that are larger or infected should be evacuated. Only one of my cases was infected.

DR. STEPHEN RUSHMORE, Boston, Mass., (by invitation) read a paper on **Purpura as a Complication of Pregnancy.** (For original article see page 553.)

DISCUSSION

DR. HENRY T. HUTCHINS, BOSTON, MASS.—The essayist has been able to find reports of only forty-six cases occurring in the last fifty-seven years. This is perfectly natural because purpura is a rare disease at best.

One or two points are important. In the first place, we know practically nothing about the etiology of purpura; and in the second place, we know really very little about the treatment during pregnancy. We cannot forestall the onset of purpura because it comes out of a clear sky and there are no signs that can be observed to prevent its occurrence.

Another point is its serious nature both to the mother and child. It would seem to me that in cases of pregnancy complicated by purpura, the little treatment we do know about has not been started early enough. At the very onset of the purpura it would seem that the uterus should be emptied, or first, perhaps transfusion started, then the uterus emptied and transfusions kept up. Most of the cases reported have been treated by transfusions after delivery. Dr. Rushmore's individual case would seem to contraindicate this perhaps because his patient aborted spontaneously and the mother did live. However, that is not the usual result.

DR. ARTHUR H. MORSE, NEW HAVEN, CONN.—I have not seen a case of purpura complicating pregnancy, but I have been interested in the blood picture as shown in patients with purpura hemorrhagica. Perhaps the most complete paper in this country was published by Duke in 1910. This author found the bleeding time prolonged in experimental animals and in humans when the platelet count was reduced to 10,000. The condition in human beings was relieved temporarily by transfusion, which caused an increase in the number of platelets. However, the increase lasted only three to five days, when the hemorrhagic diathesis returned. In a series of thirty-eight experimental animals injected with benzol, diphtheria toxin, or tuberculin, only those with a reduced platelet count bled.

During the past few months at Yale, we have done some interesting experimental work which may throw light upon this problem. Working with the male albino rat, it was found that the number of platelets in the blood could be greatly increased and the coagulation time reduced by exposing the animal to the rays of quartz lamp. The same results were found by treating the female albino rat in pregnancy.

The experimental results of the use of the quartz light were so striking that it was thought worth while to try its effect on a baby suffering from hemorrhagic disease of the newborn. This baby had had already three transfusions and when

first seen there were hematomata on the shoulders and arms, and oozing of blood from the umbilicus. The coagulation time was thirty-six minutes. The baby was first given six minute exposures, three minutes on the front and three on the back. Following this, general radiations were given for four days. After an interval of eight days the coagulation time was found to be eight minutes. The platelet count in the beginning 155,000 had increased to 550,000; the red blood cells had increased from 3,200,000 to 5,400,000.

In a second baby in whom bleeding began two days after delivery, the coagulation time was found to be nineteen minutes and the platelet count 170,000. After nine days of six minute radiations the platelet count had increased to 430,000 and the coagulation time was within normal limits.

One would conclude that since the platelets come from the megacaryocytes of the bone marrow, the effect of the quartz lamp is a stimulation of the bone marrow, resulting in a throwing off of platelets into the circulation. I do not know what the result of this treatment would be in a patient with hemorrhagic purpura, but it would seem worth while to try it.

DR. I. C. RUBIN, NEW YORK CITY.—Recently in a patient aged fourteen, vaginal bleeding was at first construed as associated with puberty and a number of measures were instituted which failed to stop the bleeding. I seriously considered radiating the ovaries by x-ray or putting radium into the uterus. Now it happened that the patient showed two small petechial spots on both underlids and on closer inspection she had fading spots on the skin, but a careful blood analysis failed to show any specific evidence of purpura hemorrhagica.

This condition is now divided into two types from the prognostic point of view. One is the acute purpura hemorrhagica which is practically always fatal; and the other is the chronic purpura hemorrhagica which some patients enter into if they are lucky enough to escape from the acute attack. For the acute attack I think there is nothing to do. This little girl showed evidences of the chronic type. She bled most profusely from the uterus and had hematemesis, epistaxis and then developed hemorrhagic spots on the skin. The platelets varied from 120,000 to 180,000 in spite of very large amounts of blood transfusion. She was so desperately ill that she was subjected to a surgical procedure which I think is well worth bearing in mind in such cases and that is splenectomy. It was done in about fifteen minutes by Dr. A. A. Berg and was followed by a blood transfusion. She stood the operation very well and as soon as the pedicle of the spleen was tied, the oozing in the wound was almost immediately less noticeable, the bleeding from the uterus rapidly became reduced and she ceased to vomit blood, her epistaxis ceased and her blood platelets within thirty hours had increased to one and a half-millions.

DR. FRED L. ADAIR, MINNEAPOLIS, MINN.—We had a case admitted to the Minneapolis General Hospital on the medical service, a woman who was pregnant and who had purpura. The question arose as to whether or not the pregnancy should be terminated but we temporized, in the meantime transfusing whenever it seemed necessary. She was carried to term and delivered successfully with no untoward results, and the infant was healthy and showed no hemorrhagic manifestation. The case will be reported in *Minnesota Medicine*. (June, 1925, viii.) She was subjected to very careful blood study, as was also the infant.

DR. RUSHMORE (closing).—On account of the time limit for the paper, there are a number of points to which I have not been able even to allude: for instance, how the platelets seem to be connected with the purpura and bleeding. They are apparently not the only factor involved because the amount of bleeding

and the tendency to bleed do not parallel closely the platelet count, although there is a general correspondence.

The chronic form to which reference has been made has been treated in several cases by removal of the spleen. This is the type to which Kaznelson refers as thrombolytic purpura, in which removal of the spleen gives prompt relief and ordinarily a cure. For chronic purpura, splenectomy is the treatment now recommended.

(To be continued in the November issue.)

OBSTETRICAL SOCIETY OF PHILADELPHIA

STATED MEETING, FEBRUARY 5, 1925

DR. EDWARD A. SCHUMANN read a paper entitled **The Deities Concerned with Childbirth Among Ancient Peoples.** (See page 570.)

DR. H. A. DUNCAN reported a case of **Granuloma Inguinale Occurring in a White Woman who also Presented an Absence of the Vagina.**

Wm. S. Ehrich in the January, 1925, number of *Surgery, Gynecology, and Obstetrics* states that but four cases in white subjects have been reported. It seems that textbooks on gynecology do not give as clear a presentation of granuloma inguinale and its treatment as the present knowledge of the subject warrants. One of the most recent editions of a most commendable book in speaking of esthiomene, which I have taken as a synonym for granuloma inguinale, says the cause is almost invariably syphilis, no mention is made of the work of Aragao and Vianna of Brazil, or of the observations of Randall, Small and Beck, confirming their work, both in the diagnosis and treatment. The author of this same recent edition in discussing treatment recommends radical vulvectomy. This seems bad enough to apply to granuloma inguinale but when you remember that he says it is a syphilitic manifestation, radical vulvectomy seems strangely out of harmony with the time.

Miss S. S., aged thirty-one, a native of Savannah, Georgia, was admitted to the Samaritan Hospital July 11, 1924. Her chief complaint was pain, swelling and ulceration of the vulva. She stated that this condition began five years ago with a small red swelling in the left inguinal region. This gradually spread and involved the vulva. She went to the Charleston Hospital where she was under treatment for seven months. At this time she received five injections of salvarsan but without any benefit. For the past seven days the ulcerated area has been raw and painful and a dull aching pain down the inner aspect of the left thigh has caused her to faint.

As a child she had mumps, and measles. As a girl in her teens she had typhoid and pneumonia three times and influenza. Although she is thirty-one years of age she says she has never menstruated. At the age of fifteen or sixteen she suffered with much backache and pain in both inguinal regions. At this time she was treated but the menses never came.

Her father died at the age of forty-two from pneumonia. Her mother died at nineteen years of age in childbirth. One brother of thirty-four is living and well.

On admission the temperature was 101.2°, pulse 104 rapid and weak. Nutrition very bad. Teeth bad. No adenopathy. Heart arhythmic and accentuation of

second aortic. Slight tenderness in right inguinal region. Labia majora were enormously enlarged, with an overgrowth of soft granulation tissue, covered with a slight clear exudate. The granulation tissue and ulceration involved both inguinal regions. The inner aspect of both thighs were inflammed and swollen. The right leg looked worse than the left, although she complained more of the left. The anus was not greatly involved. On admission vaginal examination seemed impossible without an anesthetic and was not attempted.

Wassermann negative. Smears were negative to gonococci, but smears of exudate stained by Wright's stain revealed encapsulated bacilli within the large endothelial cells.

On July 17, she was given intravenously 0.04 gm. of tartar emetic. This was followed by a severe reaction, the temperature going to 104° F. On July 20 this dose was repeated with very little reaction. On July 21 an abscess of the left thigh involving the deep tissues was opened under gas anesthesia. Within the next thirteen days she was given nine more doses of the tartar emetic. The improvement was rapid. On August 8, she was discharged from the hospital.

The abscess in the left thigh had healed completely. The hypertrophy of the vulvar tissues was still marked and there were three small raw areas on the right labia majora. Separation of the lips of the vulva revealed a small pouch one inch deep other than this there was no vagina. Rectoabdominal examination failed to reveal any evidence of uterus or ovaries.

In the dispensary she received two more injections of tartar emetic, and on September 6, all evidence of the vulvar lesions had disappeared.

DISCUSSION

DR. ALEXANDER RANDALL.—It is interesting that granuloma has been with us for so great a number of years here in Philadelphia, and has not been recognized before. My interest in it started in the publication in May, 1920 (Jour. Am. Med. Assn.), by Symmers and Frost of the Bellevue Hospital Laboratory, of two cases observed by them in that institution. Prior to that time and ever since first going on the service at Blockley in 1912, I had met the condition and not having seen it before, had accepted the teaching of the staff that the condition was tuberculosis cutis. In 1913, Dr. Alexander Uhle with Dr. Rosenberg, endeavored to prove the tuberculous nature of the lesions, and obtaining negative results, went on further with the work. Dr. Orville Horwitz in 1901, found granuloma existant at Blockley. When Symmers and Frost published their paper it was accompanied by a good illustration and it struck me that this was the condition which we were seeing and instructing students as tuberculosis cutis and letting them go out as ignorant of their ignorance as we ourselves were. On going on service in January, 1921, I determined to study such cases and we immediately found seven cases resident in the Philadelphia General Hospital, five men and two women. In the course of the next six months, seventeen cases were diagnosed; some were in the genitourinary ward, some in the skin ward and some in the obstetrical ward, in fact, they were scattered all over the hospital. We immediately turned to the original work of Aragao and Vianna of the Institute of Oswaldo Cruz, of Rio de Janeiro, who first found antimony a specific. We followed accurately their mode of therapy in treating our cases, 10 c.c. of a one per cent solution of tartar emetic intravenously. We got very good results. These growths had been excised, cauterized, x-rayed and various ointment and wet dressings used and always with recurrence. One of the main reasons that the condition was considered tuberculosis was that x-ray, persisted in, produced cicatrization in six months to a year, but the growths always recurred. Tartar emetic is becoming again a very valuable drug.

Its use is being reported extensively in Egyptian and Indian Medical Literature for almost all the tropical diseases, malaria, trypanosomiasis, bilharziasis, kala-azar, and in the cachar sore. Ordinarily, tartar emetic, as found on the market, is uncertain and impure, and what change might occur under sterilization is uncertain. We have always used it with circumspection and have never seen dangerous manifestation. Yet on the other hand, we have never seen an individual who could take tartar emetic without some reaction. The mild form is a deep aching in the bones. From that more toxic symptoms may be manifested such as a little tachycardia, following which is a hacking cough, vomiting. Such symptoms may culminate in a very severe shock similar to what we call a nitritoid reaction as seen after arsphenamine. There has been reported an occasional death. Three of our patients refused treatment, preferring the disease to the therapy. Our best advocates were those who had had granuloma for a number of years and had received other forms of treatment without results, they were always most enthusiastic. This persistent reaction made another antimony drug desired. It brought to mind some work with synthetic antimony compounds that Dr. J. J. Abel did, ten or twelve years ago. He had never used his antimonies except in experimental work, but he sent what he had, and advised me to proceed with great care in using it. We estimated the antimony in it and based our dosage on the amount of this element as compared to tartar emetic. One of the drugs was sodium antimony thioglycollate. This sodium salt cured the first patient we used it on in six doses. The second patient took the drug perfectly (we only had four doses left) and was then put on tartar emetic. Then we waited for a typical case to try the other salt on, the triamide of antimony thioglycollic acid, when in came a man with a granuloma of three years duration who had been in nine different hospitals and had been treated with everything. He was healed in nineteen days with ten injections. I then placed the structural formulae in the hands of Hynson, Westcott and Dunning, of Baltimore, and they have collaborated in a splendid way and have got out the drugs in pure crystalline form; in fact you cannot tell the injection used from an ampule of ordinary sterile water. In the sodium salt, occasionally a little precipitate of antimony sulphide occurs, which we filter off, it makes no difference, but is a little toxic. Since we started using these drugs, we have had persistently good results. We have not seen any toxicity in any case in which the triamide has been taken. We have seen but one case in which an experimental combination of the sodium salt put up with lactic acid gave a very sharp reaction, one of the most alarming I have ever seen. That patient afterwards took twenty-eight injections of the triamide without the slightest trouble. We have given over 108 injections of the triamide salt and we have not seen any reaction either general or at the site of the injection. In several cases in which the drug has been spilled outside the vein there has been a minimal local reaction. With the sodium salt we have used about 130 intravenous injections and over twenty intramuscular injections without irritation. In granuloma it is the treatment *par excellence* and better than tartar emetic.

OBSTETRICAL SOCIETY OF PHILADELPHIA

STATED MEETING, MARCH 5, 1925

DR. JOHN A. SAMPSON, Albany, N. Y., read (by invitation) a paper entitled **Inguinal Endometriosis** (often reported as endometrial tissue in the groin, adenoma in the groin, and adenomyoma of the round ligament). (For original article, see page 461.)

DISCUSSION

DR. GEORGE W. OUTERBRIDGE.—It seems to me the work of Dr. Sampson may be divided into three main phases: First, the demonstration that endometrium-like areas found in the peritoneum are in many instances the result of implants from rupture of so-called chocolate cysts of the ovary; second, the attempt to demonstrate the origin of chocolate cysts of the ovary from retrograde dissemination of bits of endometrial tissue through the tubes during menstruation; and third, the idea of lymphatic metastasis of endometrial tissue, which is the newest part of his work. The dissemination of cells as the result of rupture of chocolate cysts has been pretty generally accepted. His theory of the origin of these cysts, however, has not as yet been universally accepted, and it seems to me that it might be worth while to say something concerning some of the objections that have been brought forward, particularly in the German literature. I do this without prejudice, because I am firmly convinced that Dr. Sampson's theories are sound, but with the hope that Dr. Sampson will say something about some of these opposing ideas in closing.

One objection is made that while menstrual blood may leak back through the tube, the uterine end of the tube is so small that it is hardly conceivable that bits of endometrium can be swept out through it. A second is that the endometrium, once cast off, is dead, necrotic, and even if conceivably swept out through the tube, it would be unable to live and function as implants. Third, the objection has been raised that no actual demonstration of endometrial tissue free in the tube has been made. (I think Dr. Sampson has demonstrated malignant tissue in the tube, but not normal endometrium.) Two authors, v. Oettingen and Luden, have made the rather ingenious suggestion that these adenomatous growths originate in the serosa of the peritoneum, which is stimulated to their production by actual fluid menstrual blood leaking out through the tube and falling on the seats of predilection (Douglas' pouch, etc.). In 1923, Lauche, one of the assistants in the Bonn Pathological Institute, published in *Virchow's Archiv*, without apparent knowledge of Sampson's work, a very extensive study of ectopic adenomyomata, a typical German 75-page article going into the subject most thoroughly, in which he did not mention the possibility of transplants. Since then, however, he has gotten in touch with Dr. Sampson, and has accepted his theory for some of these cases. Although in the paper referred to he did not consider the possibility of transplants as the origin of these growths, nevertheless he brought out the very interesting fact, which has also been stressed very extensively by Dr. Sampson, and which favors strongly the latter's theory, that every instance of growths of the type under discussion has occurred in the female, none having ever been reported in the male. Lauche emphasized even more than Sampson that they occur *exclusively in the female during*

the period of sexual activity, between puberty and the menopause, and in order to explain this phenomenon he advanced the theory that they develop from the peritoneum, due to stimulation by the ovarian hormone, in the same way that premenstrual congestion and gland changes occur in the uterus.

I was very much interested indeed in hearing Dr. Sampson say so definitely and distinctly that he by no means insists upon the implantation theory for all his cases, but believes that some of them may arise from ingrowth of the peritoneal endothelium. Of course that is the theory of the German gynecological pathologist, Dr. Robert Meyer, who has always been, and still is, its strong adherent. My own interest in Dr. Sampson's work was especially aroused from the start because of four specimens of appendices which I found in doing routine pathologic examination, before any of this work of Dr. Sampson's appeared, and which show lesions practically identical with the lesions in the appendix which Dr. Sampson showed tonight, and also with four others which he published in his paper on "Intestinal Adenomyomatas," in 1922. I presented these very briefly, merely as "Card Specimens," before the Pathological Society of Philadelphia, in 1917, but the war came along soon after and I never did anything further with them. I confess it was largely because I did not know what they were, and I did not know what to call them. I showed them to several pathologists at the time, but they did not seem to be particularly impressed with these little lesions. When Dr. Sampson's work was published I was very much struck with the resemblance of these appendiceal lesions to those reported by him, and thought they might be of similar origin. However, they differ in some aspects from Dr. Sampson's. (See original article page 461.)

DR. CHARLES C. NORRIS.—The important feature of this work is, I believe, the demonstration that under certain conditions, the "ectopic" endometrium may gain access to a lymph channel and there grow. This point once established, the menstruation of this tissue and incident desquamation can be readily understood. The metastases of the desquamated particles may be looked for in the corresponding lymph glands.

As will be observed, peritoneal endometriosis presents many of the characteristics of cancer, the penetrative quality of the cells of the transplants, their rapid regeneration after menstrual desquamation, and the distribution, often seeding, either direct from the tube or after having been transplanted through the intermediary host (ovary) are all suggestive of carcinoma. Here, however, the resemblance ceases. It is my belief that the transplants are of slow growth. It is probable that many die even before the menopause and that many more fail to establish themselves after the transtubal migration.

In a recent review of 35 cases of Sampson's cyst of the ovary, it was interesting to note that quite a number had been subjected to curettage. Whether this is *post hoc* or *propter hoc*, it is difficult to determine. Dysmenorrhea is one of the chief features of these lesions, whereas curettage itself is probably a factor in the production of transtubal migration of endometrium.

At the University we have had one adenomyoma of the round ligament, the intraperitoneal portion being the area involved. In this specimen the ovaries showed Sampson's cysts and the uterus contained a number of myomata. The endometrium in the round ligament tumor was in the same cycle as that of the uterus.

DR. SAMPSON.—It has been stated that the lumen of the tube is too small for fragments of endometrial tissue to pass through it. Dr. Norris and I have found fragments of cancer in the lumen of the tube associated with carcinoma of the body of the uterus and others have reported finding the same. I have also found fragments of what I interpreted to be uterine mucosa in the lumen of the

tube, in patients menstruating at the time that they were operated upon. Occasionally the tube reacts to menstruation. This probably rarely occurs, otherwise hematosalpinx would be of more frequent occurrence. Should the tube react to menstruation some of the menstrual blood might escape into the peritoneal cavity. Some who criticize the implantation theory admit that menstrual blood at times escapes into the peritoneal cavity, but claim that the epithelium in it is dead. It is difficult to prove this. The evidence we have indicates that sometimes this epithelium is alive. We know that menstrual blood escapes into the peritoneal cavity and that the implantations occur in situations easily reached by this blood, as may be well ascertained in carefully studying the relation between the tubes and the implantations at the time of the operation. Peritoneal implantations may be present without any endometrial lesion of the ovary, thus eliminating the ovary as a possible source of these. I have studied menstrual blood by collecting it from the vagina with a bivalve speculum and also from the cavity of the uterus removed during menstruation. In these cases the epithelium in the blood removed from the uterus usually stained better than that removed from the vagina. As Dr. Outerbridge stated these lesions have only been found in women. Lemon and Mahle, in a recent paper, from the Mayo Clinic, describing the endometrial tissue in the scar of the abdominal incision after pelvic operations, state that they have never found a similar lesion in the abdominal scar of men.

I believe that the gland-like structures, in the wall of the appendix of the first specimen shown by Dr. Outerbridge, are of endometrial origin, but I doubt an endometrial origin for the lesions in the other two appendices. The small bleb on the surface of the third appendix probably arose from the peritoneal mesothelium. It is difficult for me to believe that histologically typical uterine mucosa can arise from a metaplasia of the peritoneal mucosa.

DRS. J. G. CLARK AND F. B. BLOCK presented a paper entitled **The Treatment of Uterine Fibromyomata.** (See page 560.)

DISCUSSION

DR. WILLIAM R. NICHOLSON.—It is important to realize that the operative treatment of fibroid tumors has been standardized for years. Any case suitable for radium treatment should have no mortality in good hands if operated upon. In other words, mortality in such cases is simply due to some unavoidable accident inherent in surgery. On the other hand, the mortality arises among the complicated cases of fibroid tumor in the treatment of which radium is contraindicated.

In my service at the Graduate School of Medicine of the University of Pennsylvania, we see practically no cases of fibroid tumor suitable for radium. This is because the ward patients in that service belong to the very ignorant class, and they never come in for operation until they show definite contraindications to radium, either through the size of the tumor or from inflammatory or other coexisting pathology. It is only in my private work that I see cases suitable for radium.

I fully agree with the contraindications to the use of radium as given by Dr. Block. I am also in hearty accord with his statement that it is foolish to do a panhysterectomy for fibroid tumor. We have heard a good deal lately as to the advisability of doing panhysterectomy for this condition but this operation has a higher mortality than has the subtotal hysterectomy in the same hands.

If it were necessary to take the added risk which panhysterectomy entails, we would all of us be willing to do it, but I claim that this is not the case. After a subtotal hysterectomy a cervical canal can be eradicated by the use of the cautery. Certainly the very few instances of carcinoma occurring in the canal of

the cervix subsequent to hysterectomy, are not sufficient to legitimatize the assumption of the increased mortality, even without prophylactic cauterization. With the use of the cautery, I believe that the instances of carcinoma following later would be entirely negligible.

DR. PHILIP F. WILLIAMS.—I have been quite interested in Dr. Block's presentation of the two methods of treatment of fibromyomata of the uterus, and more especially that in his clinic they have been able to obtain so large a group of cases suitable for radiation taking into consideration the narrow limits under which the case may be so treated. Apparently, small uncomplicated tumors causing hemorrhage at or near the menopause are the type suitable for radiation. I have reviewed the history of 315 cases of myoma of uterus admitted to the Presbyterian Hospital in the service of Dr. Girvin and his colleagues and I am sure that we have not had anything like a proportion of uncomplicated cases, suitable for radiation. Of these 315 cases, 90 showed pelvic inflammatory disease, there were 11 ovarian cysts, nine cases of acute suppurative appendicitis, two of carcinoma of the tubes, one each of carcinoma of the ovary, carcinoma of the fundus, and carcinoma of the cervix, two cases of cholelithiasis, and plastic operation on cervix and peritoneum was required in 10 cases. Clinically four were definitely infected, two of them showed necrosis and strangulation from twisted pedicles. Six of them showed sarcomatous and four adenomatous degeneration in parts of the body of the uterus. It is perhaps for these reasons, and also from the fact that many times at operation on a case where the question of radium had been discussed before operation and where we have found at least a certain degree of pelvic pathology at operation which could not have been determined without opening the abdomen, that the operative method has been the choice in the hands of the surgeons who have taken care of these 315 cases. There were 252 hysterectomies done. I believe for the most part subtotal, with a few panhysterectomies. There were 12 abdominal myomectomies, four vaginal hysterectomies, four vaginal myomectomies, four times a submucous tumor protruding through the cervix was removed by vaginal morcellation; 16 of the cases were not operated upon, some did not permit operation and in others it was contraindicated for constitutional reasons. There have only been two cases so far as I can see on the histories where radium has been used; once in a cardiac case; and here the result was apparently good, although I understand the woman later developed some malignant condition of the sigmoid and rectum, and had a colostomy performed. I did not see the follow-up of the other case; nor did I have sufficient time to study the morbidity of our cases. This I believe should not be higher than the general cases, for we do have many cases of myoma that remain in the hospital more than twenty-one days. In our field of work at the Presbyterian Hospital we have found that conservation of one or both ovaries has certainly lessened, or checked, the symptoms of artificial menopause in the younger women. One or both ovaries were conserved in the abdominal hysterectomies in 67 instances. So far as the mortality in the series goes it has been unfortunately somewhat higher than that reported by Dr. Block. Death occurred in nine cases at the Presbyterian Hospital. When I briefly detailed the preoperative diagnosis of these women you will see that it is not the operation for myoma, but the associated pelvic pathology which causes the trouble. The first was an impacted fibroid with acute peritonitis; the woman died of shock following difficult operation. The second case was fibroid with carcinomata of cervix, panhysterectomy; death from peritonitis. Third case, fibroid squamous-cell carcinoma of cervix, pelvic adhesions; death occurred from intestinal obstruction. Fourth case, fibroid, with pelvic adhesions, death occurred from intestinal obstruction; due to an adhesive pelvic band. Fifth case, impacted fibroid with adhesions to intestines, septic on admission, temperature 103°, death from peritonitis.

Sixth case, fibroid with pelvic inflammatory disease in cardiac case; died of dilatation of the heart twenty-two days after operation. Seventh case, fibroid with necrosis and pelvic inflammation, died on the thirty-first day after operation of postoperative pneumonia and cardiac failure. Eighth case, fibroid; died of postoperative gastric dilatation. Ninth case, fibroid with tuberculous peritonitis, septic on admission; died from toxic nephritis with uremic symptoms following operation. None of them uncomplicated cases, none of them suitable for radium. There is no doubt that excellent results are obtained in the class of cases where radium may be used. No doubt more careful selection will increase the group suitable for radiation, but as Dr. Block's operative percentage has increased in two years' time and for the reasons Dr. Nicholson stated, I feel that in any series of myoma of the uterus the operative incidence will always remain at a very high figure.

DR. FLOYD E. KEENE.—Of the many interesting points which have been brought out, I should like to stress the importance of the care one must use in selecting cases suitable for radium therapy. Based upon the experience we have had in this line of work, we have built up a list of contraindications to radium in this treatment of myomata which almost without exception guides us in the type of case suitable for operation and in the type of case suitable for irradiation, and I am confident in the assertion that when cases are chosen carefully and radium is applied to this selected group, it forms one of the most important advances in gynecological therapeutics during the past twenty-five years.

DR. STEPHEN E. TRACY.—The crux of the situation in the use of radium in these neoplasms, is one of diagnosis. I would like to ask Dr. Block, if he determines by x-ray examination whether patients have calcified areas or nodules before radium is used. Some years ago Doctor Kelly, of Baltimore, emphasized the importance of this procedure, in order to avoid the application of radium in patients with calcified fibromyomata. Quite recently I had a patient who suffered with menorrhagia from a fibromyoma. It seemed an ideal case for the application of radium, but believing as we do that most patients with such tumors should be treated with surgery we operated upon this patient and found a nodule about 8 cm. in diameter which was so thoroughly calcified that it could not be cut with a knife.

DR. CHARLES C. NORRIS.—The *sine qua non* for irradiation is accuracy of diagnosis. I would add to contraindications cases in which there is any doubt of accuracy of diagnosis. In regard to panhysterectomy and subtotal, I believe the chief reason for taking the cervix out is for discharge. That is more important than the carcinoma.

DR. J. A. SAMPSON.—My general rule in women who have not had children is to do supravaginal hysterectomy, unless associated with pelvic inflammatory disease, when the entire uterus is removed. In women who have had children, though, the general rule is a panhysterectomy. I have seen a few cases in which carcinoma has developed in the cervical stump after supravaginal hysterectomy, enough to make us always consider this possibility, particularly in women who have had children. We use radium in selected cases. It is most important, in the use of radium, to be sure of our diagnosis, as has been brought out. The main value of radium is that it checks bleeding and by creating a surgical menopause causes a retrogression of the myomata.

DR. GEORGE W. OUTERBRIDGE.—I would like to ask Dr. Block what the average dosage of radium was, and, secondly, how much actual shrinkage in size of these tumors has been observed?

DR. FRANK BENTON BLOCK.—In answer to Dr. Tracy's question, the cases are not x-rayed routinely. It may be done occasionally, I cannot answer how often. Dr. McGlinn asked about the "let alone and observe" policy as advocated by Dr. Neill; it is not the *let alone,* it is the *let alone and observe* plan—in other words keep them under observation. How many of them have been admitted to the service that did not need any treatment? There have been very few, because most of the cases that come into the hospital are examined first either in the dispensary or by one of the staff before they are admitted. If treatment is not necessary, they are not admitted, as a rule. There are about 14 in the series that were not operated upon, due to either some constitutional condition or the patient refusing to have operation when recommended. Dr. Outerbridge questioned in regard to dosage: the usual dose is 50 mg. for twenty-four hours if the patient is past the menopause. In young women, we use 50 mg. for a shorter period of time. Quite a few of them show that there has been a distinct shrinkage. Of course, you would not get a very marked shrinkage because the tumors in most of the radium cases are no larger than a four months' pregnancy to begin with, but a great many of them do shrink.

Department of Reviews and Abstracts

Conducted by Hugo Ehrenfest, M.D., Associate Editor

Collective Review

NEW INFORMATION CONCERNING THE CAUSATION AND THE SEQUELAE OF INTRACRANIAL BIRTH LESIONS

By Hugo Ehrenfest, M.D., St. Louis, Mo.

A THOROUGH consideration of all contributions of the past two or three years, touching on the question of cerebral birth lesions, would require considerably more space than is here at my disposal. I, therefore, shall limit myself to indicate briefly certain new information which in my belief distinctly advances our knowledge and understanding of the origin of such injuries and of their probable influence on the child later in life.

It seems that it must be accepted as an established fact that approximately one-half of all infants, either stillborn or dying within the first few days of life, at autopsy reveal some sort of laceration of the dura mater, or more particularly of the tentorium. Thus in one of the largest number of observations more recently summarized, Holland[1, 2] found tears in the dura mater in eighty-one of 167 fetuses, and in sixty-four of them he discovered a bilateral laceration of the tentorium. These lacerations are not necessarily responsible for the infant's death, but they well express the ever-present danger to the integrity of the dura from external mechanical factors.

Also the problem of intracranial stress as the result of changes in the shape of the skull during the process of moulding is most lucidly presented by Holland. He supports the opinion of former investigators that compression of the head raises the vault of the cranium and with it the falx, causing the falx itself or the tentoria to tear when overstretched. It is the inevitable, exaggerated compression of the skull in face and brow presentations, and its rapid compression in the delivery of the aftercoming head in breech labors, which account for the high percentage of lacerations and hemorrhages among infants born in this manner.

With certain features of this theory Greenwood[3] takes issue. He made plaster of Paris casts of the newborn's head immediately after birth, and another similar cast a week or so later. Such casts permit very exact measurements in various directions, and conclusions drawn from them force us to modify some of our ideas concerning the changes of configuration resulting from moulding. His exact studies leave no doubt that in normal cases of vertex presentations the passage of the suboccipito-bregmatic circumference through the pelvic brim does not,

as now assumed, increase the vertical diameter of the cranium. On the contrary, the tendency is to shorten this diameter and to cause merely an overlapping of the two parietal bones. The lengthening of the head is anteroposterior and not vertical. That in many vertex cases dural septa are torn is an admitted fact, but at least in normal vertex presentations this injury cannot be explained by any raising of the cranial vault. This mechanism, however, undoubtedly might be responsible for dura lacerations in occipitoposterior presentations in which there usually is some deflexion, in brow presentations and especially in breech labors. In the aftercoming head, as can be clearly shown, the vertical diameter always becomes increased. This lengthening begins with the very first contact of the head with the pelvic brim, and if there be any difficulty, the elongation will be extreme and beyond the compatibility with life.

Incidentally the fact might be mentioned that also Greenwood is convinced that the Schultze method of resuscitation might be responsible for dura injuries in some cases, as, e.g., also is claimed by Siegmund.[4]

Beitzke[5] thinks that the direction of the compression, occipitofrontal or bilateral, determines whether the tentorium is torn approximately in the middle of its free edge or at the site of its attachment to the falx. The former type of lesion is more likely to occur during excessive bilateral compression because it also causes the cerebellum to be pushed upward against the tentorium, a point already emphasized by Wilke in 1912.

By far the most significant result of recent studies consists in new information concerning the character and the later consequences of apparently common lesions of the brain substance sustained during labor. This work, chiefly done in the Pathologic Institute at Frankfort by Philip Schwartz and his coworkers, is presented by Schwartz[6] in an exhaustive, well illustrated and most instructive monograph of two hundred pages and more briefly summarized by Fischer[7] and Siegmund.[4]

One can readily agree with the allegation that the almost general adoption of Beneke's method for the study of intracranial pathology of the newborn rather one-sidedly brought about an overestimate of the significance of dural lesions, and inevitably caused the now evident neglect of injuries to the brain substance itself.

If the skull is opened, very similarly to the customary technic in the adult, but the skull flaps are made larger (by running the incision anteriorly lower down to the orbital ridge, laterally down to the attachment of the ear, and posteriorly below the transverse sinus) it is possible, while removing the hemispheres in toto, to inspect first the tentorium and then the falx. After a preliminary hardening in formalin solution, Schwartz studied the brain histologically. Hemorrhages or distinct areas of degeneration in the substance of the brain. outside the known and fairly common pial and tentorial hemorrhages, can even macroscopically be recognized in 65 per cent of all infants up to the age of five months. Their arrangement and localization can leave no doubt concerning their origin. Their distribution clearly expresses traumatization of the brain by the mechanism of labor.

The hemorrhages are within the area of the branches of the vena magna Galeni, of the vena terminalis, vena lateralis ventriculi, ramus ventricularis of the vena basalis, and of the vena chorioidea. The

areas of soft degeneration lie chiefly in the white substance of the hemispheres and in regions drained by the vena terminalis and vena lateralis ventriculi. Often extensive areas of the nucleus caudatus are found destroyed by hemorrhages from the vena terminalis.

As clearly demonstrated by Schwartz, the actual histopathologic condition in each individual observation stands in a very definite relation to the duration of extrauterine life. It might be stated in this connection that it is Schwartz's[8] belief, that the entire problem can be understood fully only by extending such exact histologic investigations to all infants dying up to thirty days after birth and even later. Thus he arrived at the conclusion that there are but a few infants that fail to reveal at least some traces of such traumatic brain lesions.

There unquestionably exists a typical progression of histologic changes, leading from hematoma through necrosis or fatty degeneration of the glia, to diffuse sclerosis, cyst formation, porencephaly, etc. In the belief of Siegmund the entire further development of the infant's brain to a great extent is determined by disturbances set up by birth, an opinion similarly but more emphatically expressed by Ylppoe, who asserts that intracranial traumatic lesions, discovered by him in 90 per cent of all prematurely born infants, actually determine whether they will live and how they will develop later.

Fischer summarizes these findings, presented in all their details in Schwartz's monograph, as follows:

"Hemorrhages in the brain substance occur in the newborn chiefly in two forms: (1) very small, and occasionally larger, isolated hematomas in the white substance, radiating in an almost typical manner from the walls of the two lateral ventricles; (2) a very typical complex of hemorrhages, arranged strand-like, often in both hemispheres, distinctly ascribable to an injury of the vena terminalis, a type first described by Schwartz and since confirmed by others."

Besides these hemorrhages there can be seen opaque, yellow-grayish spots, usually in the immediate neighborhood of the lateral ventricles, which under the microscope are found to be anemic, necrotic areas, or fields showing a softening from fatty degeneration.

The dependence at least of the hemorrhages upon birth trauma seemed evident from the start but very careful investigations finally established as well the relation of the necrotic or fatty degenerated areas to this trauma. If the degeneration is diffuse its gradual development into porencephaly can be demonstrated.

That the skull represents the all important protective factor was convincingly shown by control studies made on the brain of newborn animals (calves, dogs and cats) with thick bones and no fontanels. In not a single instance could such anomalies be discovered in the brain of these animals. Furthermore, in the newborn infants, traumatization of this character invariably was found more often and more extensively in the prematurely born and in infants with soft skullbones.

Direct pressure, strong compression of the entire brain, shearing and a sort of concussion of the brain are the traumatizing factors. They are assumed by these authors to cause circulatory disturbances through their effect on the vasomotor nervous system. Stasis or anemia is the primary result which then apparently forms the causative factors for the structural changes.

Fischer believes that Schwartz's original theory is correct, that a suction effect is created on that part of the head exposed within the

area of the dilated cervix by the difference between the higher intrauterine and the lower outer atmospheric pressure.

It seemed natural that both the immediate and the early symptoms of such traumatization of the brain should resemble those of a concussion of the brain. As a matter of fact, much clinical evidence now has been adduced to support strongly such a view.

Stern and Schwartz[9] examined one hundred live newborn babies up to the age of ten days and found in most of them periods of nystagmus to alternate with intervals during which this anomaly could not be seen. Most often the nystagmus started spontaneously, in other cases the movements could be brought on simply by a slight turn of the head to one side. The horizontal type of nystagmus prevailed greatly, and only in four babies the vertical type was present.

This rhythmic rolling of the eyeballs was most marked within the first few hours after delivery. The older the child became, the smaller were the excursions, the longer the intervals between the attacks of nystagmus. Of forty-four infants, in whom all the conditions of labor were perfectly normal, fifteen had no nystagmus, while of eleven babies, born in abnormal presentations, all showed the anomaly. Out of the twenty-four cases of contracted pelvis, twenty had a spontaneous nystagmus, and in three of the remaining four instances without nystagmus, the pelvic deformity was very slight. Of thirty-eight firstborn children only eight failed to exhibit the anomaly, while of fifty-two babies of multiparous mothers thirteen had no nystagmus. These same authors were able to demonstrate convincingly the relation both of frequency and duration of nystagmus to the degree of moulding of the head and as well to the duration of the second stage of labor. One might well accept their conclusion that the dependence of nystagmus upon some traumatization of the brain in birth now can be considered as established.

Berberich and Wieders[10] assumed that mechanical influences capable of affecting the brain to such an extent could not fail to exert some deleterious effect also on other organs of the head. Stump, Sicherer, and more recently Jacobs,[47] have proved the high incidence of retinal hemorrhages in newborn infants as the expression of a birth trauma of some sort. Berberich and Wieders also investigated spontaneous and experimental nystagmus of the infant by employing both the caloric test and the turning table. All their findings strongly support the assumption of a serious traumatization of the brain.

Distinct alterations of the inner ear, including hemorrhages have been discovered in the newborn by Voss.[11]

Schwartz feels that the almost physiologically positive Babinski reflex of the newborn (recently found positive in 43 per cent of eighty-eight normal and healthy infants within the first week of life by De Angelis[12]) will have to be studied and analyzed in the light of all this newer information concerning the condition of the brain immediately after birth. He doubts that this inverted plantar reflex has anything to do with impairment or underdevelopment of the pyramids but more likely is dependent upon an injury of the corpus striatum.

Observations of peculiar attacks of arrest of breathing in newborn and young infants, a state of normal respiration suddenly and repeatedly interrupted by periods of apnea and cyanosis, have occasionally been recorded in pediatric literature. Recently, Still[13] dealt with this perplexing condition and expressed the belief that these

attacks must be due to some affection of the respiratory center itself. A most substantial basis has been furnished for this theory by Kirkwood and Myers[14] in a thorough study of a case of inspiratory apnea ending fatally. This infant appeared to be normal and well on the first day and did not manifest the first signs of trouble until the third day. It suddenly ceased to breathe for a short while and turned blue, then again breathed normally. Several similar attacks recurred. During the state of apnea some slight twitching now was noted, a turning of the eyes, etc., and later convulsions appeared when the baby suddenly died.

Lundsden, who recently had made extensive investigations on cats concerning the exact location of the automatic respiratory center, performed the autopsy on this infant. He discovered hemorrhages in the pons which, in his opinion, paralyzed this center and therefore, with seeming justification, it is suggested by Kirkwood and Meyers that minute hemorrhages in the pons probably are not infrequent in the newborn and that they might occasionally represent the not recognized cause of a neonatal death.

Behrendt[15] emphasized the fact that "persistent spitters" among very young infants often show various symptoms of nervous hypersensitiveness, are spasmophilic or have tremors. This identical observation was recorded by Dollinger,[16] and since among his own cases many of these babies have been born after difficult labors, he concludes that the evident hypersensitiveness, presumably in part expressed in this habitual vomiting, might be ascribed to the traumatization of the brain in birth. This explanation appeals to Schwartz who like Ylppoe is surprised that obstetricians and pediatricians so long have been satisfied in applying to definite clinical pathologic conditions such terms as asphyxia, debility, atrophy or spasmophilia, which in the adult never express anything but a mere symptom. He feels that his own investigations at least justify the hope that all these conditions some day possibly will be brought into a direct and specific relation to certain brain lesions sustained in birth. Foerster's recent studies concerning the athetotic striatum syndrome seem suggestive to Schwartz, but he objects to their classification as congenital, since more intensive study of the corpus striatum in the newborn might yet establish the intranatal origin of this syndrome.

The complexity of the diversified lesions, within and on the surface of the brain, produced by the traumatism of moulding, their usual multiplicity, peculiar distribution and wide variation as to size of the resulting hematoma, all these many factors explain why it is impossible to evolve a definite picture of the symptomatology of intracranial birth hemorrhages, why in the greatest majority of instances the lesion cannot be satisfactorily localized even when certain clinical manifestations or findings establish its existence. Cameron,[17, 18] Capon,[19] Henkel,[20] Holland and others deal with the early general symptomatology which by now is well known: anomalies of respiration, cyanosis, inability to suckle, twitching, convulsions, paralysis, bulging of fontanels, separation of sutures, etc., but they are unable to offer any new helpful suggestions in regard to better evaluation and interpretation of such findings.

The long appreciated value of a spinal puncture for the diagnosis of intracephalic hemorrhage is emphasized by Sharpe[21, 22] in several papers, or as I would say, overemphasized. The mere presence of

blood in the spinal puncture fluid can hardly be accepted as proof positive of an intracranial hemorrhage, since, e.g., so recognized an authority on spinal fluid as Levinson[23] quite recently wrote: "Obtaining bloody fluid is possibly the most frequent mishap in spinal puncture on infants. It happens to both the inexperienced and the experienced. The blood is due to injury produced to the plexus of veins in the canal."

It furthermore might be doubted that a seemingly increased pressure of the spinal fluid, ascertained at the time of puncture, is of any great value for the diagnosis of increased intracranial pressure due to hemorrhage. It so happens that I discussed this very point with Professor Baranyi and he assured me, as have other experienced pediatricians, that the outcome of the measurement of this pressure is so greatly dependent upon the position of the baby at the time of the puncture, upon the character of respiration, and is so markedly influenced by crying, that the actual figures obtained in this manner are practically void of any significance.

The problem of immediate diagnosis is further complicated by the fact that symptoms, even of evident hemorrhage, may not appear until much later. A somewhat extreme but most instructive observation of this sort is recorded by Schele.[24] This baby died rather unexpectedly when six weeks old. Autopsy showed a large subdural hemorrhage from a deep tentorial tear. Since this baby, to Schele's best knowledge, had not sustained a head trauma since birth, he assumes that a small tear, occurring at birth, did not heal properly, possibly as the result of an intercurrent acute febrile condition, and later reopened and further extended into the sinus transversus.

The delayed appearance of the signs of hemorrhage in some cases undoubtedly is due to persistence of a slight hemorrhage from a small vessel on account of the inability of the blood to coagulate properly. However, it is not justifiable to claim, as recently done by Kaiser,[25] that a hemorrhagic diathesis often is the direct and sole cause of an intracephalic hemorrhage of the newborn. I[26] take issue with Munro and Eustis[27] for classifying hemorrhagic diathesis as one of the immediate etiologic factors in their grouping of the causes of cranial hemorrhages, and also Conkey[28] feels that at present the hemorrhagic disease theory is overstressed to the exclusion of the causative mechanical and traumatic factors. It is true that Cruickshank[29] in an analysis of the pathologic findings in 400 newborn infants assigns first place to hemorrhagic disease as the chief cause of hemorrhages, but it should not be overlooked by writers quoting him that he speaks of all types of hemorrhages in the various tissues and organs of the newborn infant.

In my belief, the primarily traumatic origin of intracranial birth lesions now has been definitely established by the comparative studies of Schwartz on the brains of newborn infants and of newborn animals with hard skulls and no fontanels, mentioned in foregoing pages, and furthermore is convincingly demonstrated by all recent information concerning the high frequency of such injuries in breech labors, as well as in prematurely born infants.

This high incidence of fatal intracranial lesions in breech labors can be plausibly explained only by decidedly unfavorable, mechanical factors inherent to the abnormal mechanism in the delivery of the head (Capon, Crothers,[30, 31] Greenwood, Saenger[32]), though ad-

mittedly the risk is increased by undue haste during extraction of the head as emphasized by Holland, Pierson,[33] myself[34] and others.

The immediate dependence of intracranial injuries upon birth trauma, however, probably is yet more convincingly shown by the fact that the ratio of their frequency and more in particular the degree of their seriousness are directly proportionate to the stage of prematurity. Beyond question the skull bones represent the protective factor of greatest importance. Hard-skulled full-term infants are less exposed to the damage of excessive external trauma and of exaggerated moulding. This latter fact was well illustrated in one of my cases.[26] An inappropriate attempt to extract an evidently overcarried baby with a very large head by means of a high forceps resulted in fractures of both parietal bones, but the dura mater septa were found intact. In newborn animals with skulls without fontanels not any kind of traumatization of dura or brain can be discovered. The shape of the soft and elastic cranium of the premature infant, on the other hand, easily and often quickly is altered to a dangerous and disastrous degree. The obstetrician must never forget that this exaggerated configuration, as definitely established by careful observations, can be effected also by the soft portions of the birth channel (Vogel[35]), by a not completely dilated cervix, a rigid perineum or a narrow vulva ring. This accident is particularly prone to occur when the expulsion takes place quickly, that is, just in labors which to the satisfaction of the mother are easy and quick.

Raisz[36] discovered in eighty-one autopsies of full-term newborns, exactly as in the forty-two autopsies of premature infants, signs of intracranial hemorrhage in 33.3 per cent; when he, however, considered the number of instances in which such a hemorrhage actually was responsible for death, he found among the full-term infants fatal hemorrhages only in 5.12 per cent, but in 23.8 per cent of the premature infants.

Another factor of great weight, however, is the evident fragility of the blood vessels in premature infants. Two newer contributions of Ylppoe[37, 38] must be mentioned in this connection. Ylppoe experimentally produced skin hemorrhages by creating a negative pressure by means of a suction bulb. In this manner he ascertained that in infants weighing less than 1000 grams, a pressure of 150 mm. Hg. is sufficient to cause hemorrhage owing to the rupture of vessels. At a weight between 2000 and 2500 grams the required pressure was 400 mm. Hg., while in infants of 3000 grams and above, this pressure had to be raised to 520 mm. Hg. to cause hemorrhage. These findings, at least in part, would explain hemorrhages in the premature infant if we take into consideration the fact that the average of normal pressure in delivery at 250 mm. Hg. for small premature infants actually transgresses the resistance of their blood vessels. This theoretical deduction he was able to establish as correct in another series of observations in which he demonstrated an inverse ratio of the frequency of brain hemorrhages to the degree of development. He found brain hemorrhages in 90 per cent of infants weighing less than 1000 grams, in 76.5 per cent weighing between 1000 and 1500 grams, in 35.3 per cent of those between 1500 and 2000 grams, and in 26.7 per cent weighing between 2000 and 2500 grams. He feels certain that the further development of a premature infant is actually determined in the main by two factors, by its birth weight and by the degree of its

traumatization in birth. Among premature infants, later in life, appear with striking frequency pathologic conditions, which are clearly referable to the central nervous system, and especially anomalies of intelligence.

In a large series of premature babies which he was able to follow for a longer time there were seven to eight per cent of imbeciles and idiots, three per cent alone developed a typical Little disease. He calculates that 40 per cent of premature infants, which had supposedly spasmophilic convulsions in the first and second year of life, later manifested evidences of cerebral defects of varying degrees, very often expressed as deficiency of mentality.

This problem of the relation of meningeal birth hemorrhages to later faulty physical and mental development, outside of Schwartz and others already quoted, is thoroughly discussed also by Cameron and Osman,[17] Gordon,[39] Hamill[40] and others. Stroehm,[41] Ceelen, Schwartz, and Siegmund deny the existence of an encephalitis interstitialis of young infants as first described by Virchow. Burhans and Gerstenberger[42] confirm the assertion of Rosenberg or Finkelstein that an internal hemorrhagic pachymeningitis in early infancy is more common than is generally believed. They feel certain that in some infants a subacute pachymeningitis originally resulting from a birth hemorrhage, later is rendered acute by some further physical injury.

An interesting historical outline of gradual change in views concerning the significance of convulsions in early life for later epilepsy can be found in an article by Patrick and Levy.[43] In their own studies they were able to ascertain for 500 cases of idiopathic epilepsy an incidence of early convulsions amounting to probably more than 20 per cent, while in another group of 752 unselected infants and children the frequency of early convulsions amounted only to about 4.2 per cent, about one-fifth that of the epileptic group. Thus they are forced to conclude that the presence of an infantile convulsion *per se* multiplies the individual's ordinary chances for later epilepsy at least by five. However, there is a preponderating number of but one single infantile convulsion in the nonepileptic group.

A careful analysis of the figures presented by these writers reveals still another fact which must be significant to the obstetrician though it is not stressed by them. In the epileptic group I find the incidence of convulsions to be almost twice as large within the first four weeks postpartum, and three times as large within the first five months of life than in the corresponding ages of the nonepileptic group. If we admit that birth trauma plays a rôle in the causation of early convulsions, the conclusion strongly suggests itself from these figures that it also might be an etiologic factor of some importance in the occurrence of epilepsy.

Of special importance to the obstetrician necessarily prove recent contributions dealing with the problem of prevention of intracranial damage in birth.

At present the view prevails that the chief rôle in the causation of tears in dural septa is played by the traumatic factors of exaggerated or rapid compression of the fetal head. Of only secondary, though admittedly considerable importance in the origin of hemorrhages are furthermore: distension of blood vessels or sinuses owing to asphyxia; the fragility of the vessel walls in the premature infant, and a hemorrhagic diathesis which favors the gradual escape of a large quantity

of blood even from small vessels. More recently, chiefly through the work of Schwartz, multiple hemorrhages and degenerative processes within the brain substance have been brought into immediate etiologic relation to certain circulatory changes, hyperemia or anemia, both the result either of vasomotor disturbances or of an uneven blood distribution due to the suction effect exerted by the lower outer atmospheric pressure on the portion of the head exposed within the area of the dilated cervix.

A clear conception of all these various causative factors enables us to develop certain rules for an effective prophylaxis.

We should not make use of an artificial method of delivery which tends to further increase an already existing cranial stress in a certain direction. This point is very lucidly set forth in the paper of Greenwood already mentioned. "Forceps will increase the danger to the child if it increases compression of an already compressed diameter. Forceps may be to the good, if it compresses a diameter compensatorily lengthened by the moulding thus actually affording relief of tension on the septa." Theoretically at least, it then would seem reasonable that the application of the forceps in a direction approaching the anteroposterior diameters of the head would imply not only less risk but might be a means of reducing the anteroposterior strain. On the other hand, from this same viewpoint, forceps would seem especially risky in brow and occipitoposterior presentations, and also on the aftercoming head, because under these conditions the forceps very likely would tend to further increase the already present vertical elongation of the cranium, which proves so particularly dangerous to the tentorium. Therefore, no means should be spared in the effort to obtain better flexion of the partially extended head, to change an occipitoposterior into an anterior presentation, or to obviate a breech labor by external version.

The particular usefulness of the Kielland forceps for rotating the head is emphasized by Saenger[32] who failed to discover an intracranial hemorrhage in any of his own cases where this forceps alone had been employed. However, it is not surprising that such hemorrhages also have been recorded after the use of the Kielland forceps since as a matter of fact they do occur after spontaneous labors of women with perfectly normal pelves.

The stress, due to vertical elevation of the cranium of the aftercoming head during a breech delivery, is relieved by pressure on the head from above, which not only reduces required traction from below but also produces and maintains better flexion of the head. This latter important effect, in my belief, too often is not sufficiently appreciated. Appropriate help on the part of the assistant, who exerts this suprapubic pressure, implies the necessity that the direction of this pressure be not straight downward but always oblique, either from the left or the right according to the position of the occiput. This suprapubic force, especially during an uterine contraction, or when combined with traction from below, as shown by Crothers, must not be too strong since otherwise collapse or death of the infant might result from the resulting herniation of the medulla through the foramen magnum.

The evident vulnerability of the blood vessels in the premature infant makes it necessary to refrain from all medication or operative

measures which hasten the passages of the child through not fully dilated soft portions of the birth canal.

More perplexing from the standpoint of prevention prove the risks inherent to unequal distribution of the blood within sinuses and vessels, expressing itself in either localized anemia or congestion. This latter condition obviously also is closely connected with general asphyxiation of the fetus, another element in the causation of hemorrhages. Must we try to overcome seemingly excessive or long continued compression of the head by a forceps extraction as soon, or even before, we notice certain symptoms which supposedly indicate beginning asphyxiation? Gamper[44] reminds us that today every obstetrician very naturally will endeavor to find the answer to the question: Does the forceps more often directly cause intracranial damage than it possibly can avoid by application at the proper time?

Personally I have come to the conclusion that a definite answer to this question never can be formulated. In the light of our present knowledge concerning late effects of cranial birth lesions it is entirely illogical to gauge the risk of the forceps extraction or of any other obstetrical operation solely by fetal mortality statistics. Furthermore, the specific restriction of the application of the forceps to "the proper time," neither too early nor too late, actually is void of any real meaning, because it leaves the decision as to the propriety of the time unavoidably to the judgment of the operator. That this judgment even among recognized experts varies within very wide limits is clearly seen in the statistics from different large obstetric clinics. A calculation of the danger of forceps extraction from such really incomparable statistics carries no conviction as pointed out by Gamper. If one simply compares the forceps frequency of a certain clinic with its neonatal mortality, support is found for the view of Heinlein, that in general there probably exists an optimum of forceps frequency which lies between two and three per cent of all deliveries. It seems that a higher rate of forceps application often is associated also with a higher fetal mortality. But on the other hand, that a well-marked conservatism does not necessarily cause immediate harm, in my opinion, is demonstrated by figures from the Frauenklinik in Graz, presented by Santner[45]: In a total of 21,140 deliveries, forceps were applied in only 0.82 per cent of the cases with a total fetal mortality of 2.37 per cent, which as shown by Santner is a lower mortality than in any other reported large series with higher forceps incidence. "We believe," he writes, "that careful preservation of physiologic and normal action of the natural forces results in the best and safest form of delivery. If they seem insufficient we first try to strengthen and support them, and only if we fail in this endeavor, or if other threatening signs force interference, only then we resort to instruments or other artificial means."

No one familiar with the problem of cranial traumatization in birth can fail to agree heartily with this sound conclusion and advice. Of course, this does not mean that one should unconcernedly watch a head pressing hour after hour through the pelvic outlet against an unyielding perineum since "this is inviting disaster" as Greenwood very appropriately states. In such a situation the proper treatment consists in episiotomy, and if then expulsion does not follow, in gentle extraction with the forceps.

It can never be justifiable to apply forceps simply for the purpose

of shortening labor in the interest of the mother. Even the mere changing of the fetal heart rate, however, offers no indisputable indication for immediate interference.

A slowing of heart beats in the second stage of labor, states Bartram,[46] might mean an accumulation of carbon dioxide. The interference with the required oxygen supply to the fetus might be due to abnormal conditions either in the placenta or in cord circulation, or it might as well express existing intracranial hypertension. If the hypertension is caused by an intracranial hemorrhage, operative delivery obviously would fail to bring help. If it is due solely to excessive moulding, a relief from the dangerous outside pressure certainly would be desirable but unfortunately application of the forceps and extraction might actually augment this pressure and then certainly the interference must do more harm than it can do good.

Summarizing briefly new information gained in the past few years concerning intracranial birth injuries, we can state:

A fact, previously only suspected, now is definitely established, namely, that cerebral injuries of various character and different degree occur by far more often than was suggested by the discovery of lacerations of dural septa in approximately one-half of the infants either stillborn or dying within the first few days of life.

We understand clearer than heretofore the relation of such lesions to anomalies of physical and mental development of the child.

We should consider with greater concern every artificial method of hastening the expulsion of the fetus, especially if we know it to be premature. We should remember the unquestionable fact that haste of any kind might imply a risk to the child far greater than the possible benefit the quicker delivery is expected to offer to it.

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Selected Abstracts

Placenta

Schmitt: On the Regulation of Placental Breathing. Zentralblatt für Gynäkologie, 1924, xlviii, 489.

Schmitt gives the results of his investigation of gas interchange through the placenta. He believes that the vascular dilatation of the placenta is dependent upon oxygen tension as well as the hydrogen-ion concentration of the surrounding fluids and of the tissues themselves, and that the regulation of the placental circulation is in accord with the needs of the fetus as follows:

Decreased oxygen content of the fetal blood results in incomplete oxidation of the tissues with acid products of metabolism, and in increase in the hydrogen-ion concentration of the tissues. The acidity of the tissues causes dilatation of the vessels; and with the vessels once dilated more blood streams through the placenta in a given time, and more fetal blood is arterialized. The resultant increased oxygen content of the fetal blood, causes a complete oxidation of the acid products of metabolism in the tissues, and the hydrogen-ion content then decreases; the placental vessels are again contracted and the fetal blood receives less oxygen from the maternal blood; as a result of the lessened oxygen content of the blood, the oxidation in the tissues is again incomplete, the acidity of the tissues increases and the vessels again dilate.

As to the question of whether oxygen tension or hydrogen-ion content of the fetal blood is the more important for the regulation of the circulation of the placenta, Schmitt thinks that the oxygen itself has a regulating influence on the vascular tension through alteration of hydrogen-ion concentration of the tissues, but oxygen concentration of the blood and hydrogen-ion concentration of the tissues are inseparable and work together so far as the placenta is concerned.

Little.

Lewis, Warren H.: Hofbauer Cells (Clasmatocytes) of the Human Chorionic Villus. Johns Hopkins Hospital Bulletin, 1924, xxxv, 183.

Examination of fresh villi (immersed in Locke solution with neutral red) from nine human specimens, varying in age from six and one-half to seventeen weeks,

revealed scattered Hofbauer cells throughout the stroma in the large spaces between the reticular mesenchyme cells. They are not to be distinguished from the clasmatocytes so common in adult and embryonic tissues. No especial relation was observed either to the blood vessels or to Langhans layer, but they seem to be more or less evenly scattered throughout the stroma, usually a distance of from one to three cells apart. Villi from full-term placentae contain relatively fewer Hofbauer cells than those from younger stages. They lie between the blood vessels and Langhans layer.

Examination of fixed material revealed no Hofbauer cells in villi from early stages (two, three, and five millimeter embryos), probably because of poor fixation or poor staining. They increase rapidly in number until the fetus reaches a crown-rump length of 204 millimeters. They are fairly abundant in full-term villi.

Lewis' observation confirms the work of Meyer that the Hofbauer cells are not necessarily pathogenic for hydatiform degeneration.

The specimens gave no clear indication of the origin of Hofbauer cells. They probably have phagocytic properties and clear up the tissue spaces of escaped blood cells and other dead material, and perhaps also guard the fetus against bacterial invasion from the mother. C. O. MALAND.

Williams, J. T. and Mallory, F. B.: Angioma of the Placenta. Surgery, Gynecology and Obstetrics, 1921, xxxii, 523.

The scarcity of placental tumors prompts the authors to report this case. A primigravida was delivered of a normal child. The otherwise normal placenta contained two, more or less encapsulated tumors, one measuring 10.5 × 10 × 6 cm., the other being 3.5 cm. in diameter. Microscopic examination showed the tumors to consist of thin-walled capillary blood vessels embedded in a fairly abundant connective tissue stroma. Mitotic figures were present in many of the cells lining the vessels. Some of the red blood cells in the capillaries were found to be nucleated. R. E. WOBUS.

Greenhill: The Association of Fetal Monstrosities with Placenta Previa. Surgery, Gynecology and Obstetrics, 1923, xxxvi, 227.

In line with Mall's assumption that defective development of the fetus is due to faulty implantation, Greenhill tries to show that fetal monstrosities are relatively common in cases of faulty placental implantation, i.e., in placenta previa. He reports seven cases occurring at the Chicago Lying-in Hospital in which the two conditions were associated, and he collected fifteen more cases from the literature. This, he feels, is a rather incomplete list as the cases may be reported under other titles.

As a practical deduction, he advises that before doing cesarean section in placenta previa, in an effort to save the child, an x-ray examination be made to ascertain if the fetus presents any striking abnormalities.

R. E. WOBUS.

Strachan, G. I.: Placental Changes in Relation to Fetal Death. British Medical Journal, September, 30, 1922, p. 594.

The author considers chiefly two conditions: (1) The syphilitic placenta. He mentions some diagnostic points relative to the microscopic and macroscopic diagnosis of placental syphilis. (2) Placental infarction. The author considers that placental lesions constitute one of the important conditions causative of or associated with stillbirth. F. L. ADAIR.

Ederer: Objective Demonstration of the Completeness of the Placenta. Muenchener Medizinische Wochenschrift, 1921, lxviii, 916.

The author injected 200 c.c. of milk into 250 placentas where the completeness of the afterbirth was in doubt. While a torn surface, allowing milk to escape, is not positive proof that the placenta is incomplete, a negative result of the milk injection is absolute evidence that the placenta is intact. S. B. SOLHAUG.

Forget-Urion: Hydraulic Separation of the Placenta. Le Progrès Médical, 1924, No. 33, p. 497.

Hydraulic freeing of a placenta that fails to separate because of either adherence or uterine inertia is advantageous because it reinforces the physiologic processes. The technic consists in cutting the umbilical cord at the vulva and introducing by means of a cannula sufficient fluid into the umbilical vein to forcibly distend the placenta. From 200 to 1500 cubic centimeters are usually used and considerable pressure is necessary.

The advantage of this procedure is that it gives good results without the danger of infection which accompanies manual removal. The disadvantages are that it requires special instruments; it consumes time and is therefore not applicable in the presence of active hemorrhage; it is not always successful; and it is not without danger. In support of this last objection, Forget-Urion cites a case where, thirty minutes after the injection, the patient developed a sudden chill. He brings out the similarity between this chill and those following intrauterine injections. The etiology of this condition he believes to be either a nervous shock, the passage of fluid into the peritoneal cavity, or the entrance of fluid through the uterine sinuses into the maternal blood stream. THEODORE W. ADAMS.

Guillemin, A.: Prolonged Aseptic Retention of a Placenta (Eighteen Months). Bulletin de la Societé d'Obstetrique et de Gynécologie, 1925, xiv, 186.

A twenty-three year old patient had a miscarriage at five and a half months. No complications occurred and the patient made a normal recovery. Menstruation did not return until three months later. The following month the patient did not bleed but two moths later she bled profusely. She consulted a midwife who made a diagnosis of a second miscarriage. For thirteen months following this there were no menses. Then, eighteen months after the first miscarriage, the patient had a profuse hemorrhage and showed signs of marked anemia. Examination revealed a hard mass, the size of a fist in the vagina. This proved to be a mass of placental tissue. A few placental remains which were in the uterus were removed by curettage. Recovery was uneventful and menstruation returned five weeks later, since which time it has been regular. J. P. GREENHILL.

Schmidt. H. H.: Retention of Portions of the Placenta. Medizinische Klinik, 1924, xx, 1241.

In doubtful cases the safest way to determine whether pieces of placenta have been left in the uterus is to explore the uterine cavity immediately after labor. However, in many instances retention of placental elements may be avoided by the proper conduct of the third stage of labor. The most common cause for incomplete expulsion of the placenta is a premature and improperly performed Credé expression.

The proper conduct of the third stage is as follows: If bleeding occurs during the third stage, determine by various signs whether the placenta is in the uterine cavity or lying free in the lower uterine segment. These signs are upward exten-

sion and diminution in size of the uterus, advance of the umbilical cord, etc. If the placenta is in the lower uterine segment, simple pressure on the contracted uterus will expel the placenta. If the latter is still in the uterine cavity and hemorrhage excessive the abdominal aorta should be compressed. If a mechanical aorta compressor is not available, manual compression will serve. Usually the bleeding ceases because of uterine contractions due to the resulting anemia. If this fails, 500 or 600 c.c. of sterile water should be injected into the umbilical vein. Not until this method fails should the Credé maneuver be attempted. The latter usually succeeds in expelling the entire placenta because it is full of fluid.

In some cases where retained portions of the placenta are not removed immediately after labor but where attempts are made to remove them some time after labor, the patients develop sepsis and die. Because of this, if infected retained placental elements are suspected in a patient who has fever during the puerperium, a hysterectomy should be performed. In some cases, however, cures are obtained with conservative treatment. The important thing to remember, however, is that if a piece of placenta remains in the uterus it should be removed immediately after labor and not in the puerperium after infection has taken place.

J. P. GREENHILL.

Heidler, H.: Treatment of Disorders of the Third Stage of Labor. Wiener Klinische Wochenschrift, 1924, xxxvii, 793.

X-ray studies of the third stage of labor, as reported by Weibel and Warnekros, show that just after the completion of the second stage of labor the placenta is still adherent to the uterine wall and that detachment begins with the first uterine contraction after the delivery of the child. The retroplacental hematoma does not have the important rôle that Frankl has assigned to it in this detachment but is only of secondary importance. The placental detachment may be diagnosed by the following clinical signs: (1) The fundus uteri becomes narrower and rises to two fingers' breadth above the umbilicus. The lower uterine segment broadens as the uterus contracts. (2) Kuestner has shown that, if the anterior abdominal wall is pressed against the posterior abdominal wall just above the symphysis, one of two things occurs. If the placenta is still adherent that portion of the umbilical cord lying outside the vulva will recede. But if the placenta is freed, the cord will advance. (3) Ahlfeld has shown that, if a marker is placed on the umbilical cord just at the vulva, the cord will be seen to advance following placental separation. (4) If the umbilical vein can be palpated by pressure on the fundus, the placenta is still attached according to Strassman. (5) Slight "separation hemorrhage" which is physiologic, can be seen after separation. (6) Piskacek, Calmar and von Mikulicz-Radecki have described a subjective symptoms of placental separation, viz., the patient experiences a feeling of pressure on the rectum when the placenta is in the lower uterine segment or in the vagina.

Placental separation must take place within thirty minutes to be considered physiologic. If no hemorrhage occurs the condition is a simple retention for which nothing need be done. The cause of this may be due to malpositions, malformations or uterine tumors. If, it is due to contraction of the internal os, "incarcerated placenta," the contraction is easily overcome by complete surgical anesthesia. Finally there is the rare "placenta accreta" in which the chorionic villi invade and penetrate the uterine muscularis; here spontaneous placental separation cannot take place and the only treatment is hysterectomy. This is one of the most dangerous complications of the third stage of labor.

In the ordinary case of "adherent placenta," there is no need for haste if no hemorrhage occurs. After one hour the placenta may be filled with 300 c.c. saline

solution through the umbilical vein. This method is usually ineffective but may be tried as it is absolutely harmless. The author has found it unsuccessful in 73 per cent of cases and in the remaining 27 per cent he could not say definitely that the separation was due to the method employed. If the placenta is adherent after three hours in spite of repeated attempts at saline injections, the author believes in active treatment despite reports in the literature (Tweedy, Frankl, Lindig) of cases in which placentae were retained for weeks without causing any damage to the mother.

Hypodermics of ergot and pituitrin are now given and the original Credé expression attempted; if this is unsuccessful it is repeated under complete anesthesia. Manual removal of the placenta should next be tried and the author does not believe that it is as dangerous as often is claimed. In 228 cases, the author's mortality was 0.5 per cent. It is a risky procedure only in the presence of fever, pathologic vaginal secretions, endocervicitis, and leucorrhea, and in such cases shows a very high mortality. Removal can be accomplished easily in the majority of cases if the proper line of cleavage can be found. Strict asepsis must be maintained.

Hemorrhage in the third stage is another frequent complication. It may be due to tears, or to uterine atony. Ergot and pituitary extract are immediately given, and if the placenta is detached, it is at once expressed. If still attached, however, Credé expression is attempted and repeated under ether anesthesia if necessary. Bleeding can be controlled by aortic compression, using the compressor of Sehrt, which the author has found very reliable. If not successful, manual removal is done and the author injects 1 c.c. of pituglandol directly into the uterine musculature under the guidance of the hand in the uterine cavity. RALPH A. REIS.

Larisch: Prolapse of the Normally Situated Placenta. Monatsschrift für Geburtshülfe und Gynäkologie, 1924, lxvii, 278.

Larisch states that in the last twenty years not a single case of prolapse of the normally situated placenta occurred at the Breslau clinic. But in the outdepartment a case was recently observed. A quintipara who had a transverse presentation and a prolapse of the cord had a mild hemorrhage from the uterus. On examination the entire placenta was found free in the vagina and it was removed. No bleeding occurred but when a foot was brought down, brisk bleeding started. This stopped immediately after extraction of the baby, which was dead.

The following causes of prolapse of the placenta have been mentioned: mechanical insult, a pathologic condition which prevents proper union between the placenta and the uterus, hydramnios and multiparity whereby the uterus diminishes markedly in size after expulsion of a part of its contents, and an absolutely or relatively short cord. In the reported case the author believes trauma played a part because for a few days before labor the patient coughed violently. The prognosis for the mother is serious because of the danger of hemorrhage and infection.

J. P. GREENHILL.

Nubiola, P.: Placentolysis in Uteroplacental Apoplexy. Revista Espanola de Obstetricia y Ginecologia, 1924, ix, 49

In describing the pathologic anatomy of placental apoplexy little attention has been directed to changes in the tissue of the placenta. Nubiola reports the histologic examination of placentas obtained in five typical cases, in which were found: (1) Enormous dilatation of the villous capillaries, engorgement of the small veins, and empty condition of the arteries; (2) Rhexis of the vessel walls

with extravasation of blood into the stroma of the villi or directly into the sinuses; (3) Histolysis of the placental zone proximal to the coagulum.

He concludes that in this condition there is a mingling of maternal and fetal bloods, causing histolysis of many villi in the neighborhood of the hematoma, while at the same time interstitial hemorrhages occur in the uterus, adnexa, and even in other organs. The production of fibrinoid substance, of red and white infarcts, and uteroplacental apoplexy are due to the same underlying process in different degrees, the etiology being probably a conflict of materno-fetal nutritive relations, and not the liberation of a toxic placental substance. Placental apoplexy should be classified clinically and pathologically under the heading of toxemia of pregnancy.

THOS. R. GOETHALS.

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Dr. James E. Davis, Detroit, Mich., Secretary;
Dr. Geo. Van Amber Brown, Detroit, Mich., Asst. Secretary;
Dr. Wm. G. Dice, Toledo, Ohio, Treasurer.

Members of Executive Council, Dr. John O. Polak, Brooklyn, N. Y., and Dr. Edgar A. Vander Veer, Albany, N. Y.

The next place of meeting will be The Drake Hotel, Chicago, Ill., September 21, 22 and 23, 1926.